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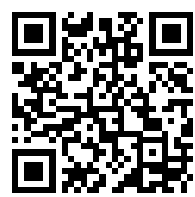

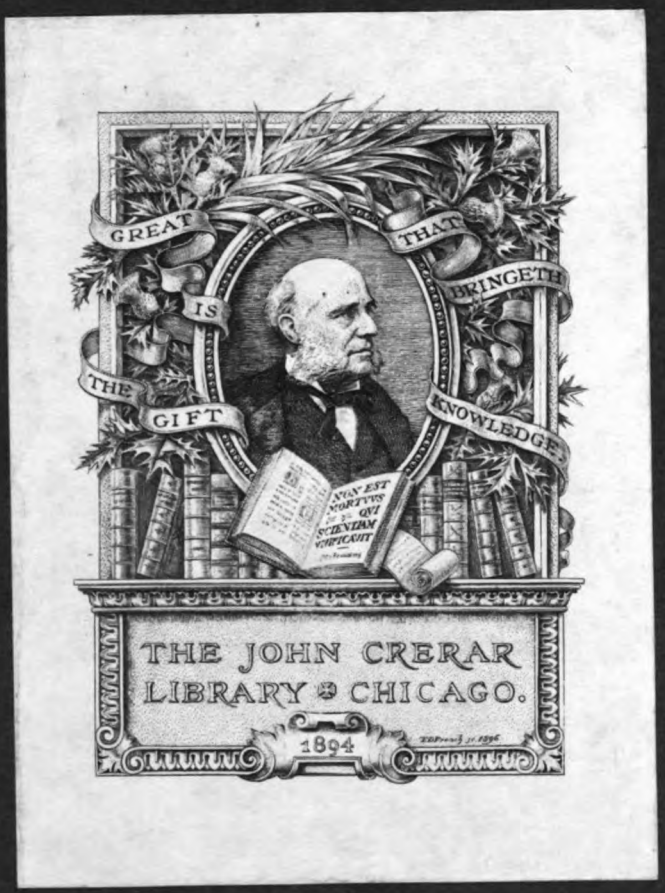

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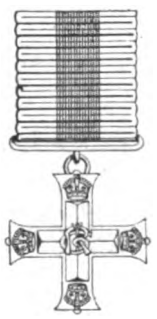

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THE CAMEROONS CAMPAIGN, 1914—1916.

A Lecture delivered at the Royal Artillery Institution, on Thursday, 12th February, 1920.

BY COL. A. H. W. HAYWOOD, C.M.G., D.S.O., R.A.

Major Genl. G. H. A. White, C.B., C.M.G., D.S.O., Comdt., Royal Military Academy, in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, I have much pleasure in introducing, to those who do not already know him, Colonel Haywood, who has kindly come down here to lecture to us on the Campaign in the Cameroons between 1914 and 1916.

Speaking personally, the subject of the lecture, I regret to say, is one about which I know little. There may be some other members of the audience who are similarly situated and, if so, I am sure they will look forward as I do to gaining some knowledge of a very interesting theatre of war, and one about which none of us ought to be ignorant. To those who are better informed I am sure the lecture also cannot fail to be of great interest. I will now ask Colonel Haywood to proceed with his lecture. (Applause).

COL. HAYWOOD: General White, Ladies and Gentlemen, I think the first thing to do is to explain the map of the Cameroons to those of you who do not know it. The country before the war was surrounded, on the north and west, by British Territory and on the east by French territory—French Equatorial Africa—and along the south also by French Equatorial Africa. The west is the seaboard, the Atlantic. The small island of Fernando Po, belonged to the Spanish, and it was of considerable importance, because it formed a possible refuge for small boats running ammunition and stores over to the Germans in the Cameroons. In the south-west corner of the Cameroons is the small colony of Rio Muni which is also Spanish.

The strategical importance of the Cameroons to the enemy consisted in the possession of one of the finest natural harbours on the west coast of Africa, that is, Duala. Most of the harbours on the west coast of Africa have a bar in front of them so that they are very difficult to navigate by coasting steamers, but Duala was better situated in that respect. Secondly, the strategical importance to the enemy consisted in the possession of the wireless station at Duala and, thirdly, there was the value of the Cameroons as a whole in forming a connection between east and west Africa in the German project of a trans-continental railway from German East Africa to German West Africa which they hoped to complete some time or another by

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absorbing the Congo. In order to deny the benefit of these advantages to the enemy, it was necessary to send out an Allied expedition whose objective was, first of all, Duala. After the capture of Duala, it was necessary to pursue and destroy the enemy s forces.

Our local command of the sea was of great importance. The Navy did excellent work in stopping ammunition and food supplies reaching the enemy at various points on the coast and in co-operating up creeks with the land operations. Numerous creeks run up from the coast and are navigable for a short distance inland. In patrolling those creeks and reconnoitring generally the Navy were of the very greatest help. In addition the Navy maintained a blockade on the coast and stopped gun running and the running of supplies from Fernando Po or from any ocean steamers that might approach the seaboard of the Cameroons.

To understand the difficulties of keeping up communication between the different groups of the Allied Forces, it is necessary to realise that the extreme length of the country from north to south is 800 miles, that is to say from Lake Chad down to Ouesso, and the extreme breadth from west to east is about 600 miles. The topography of the country necessarily varies considerably owing to the large area it covers. The main features are, first, the Cameroon Mountain rising to 13,000 ft., in the south-west, in the neighbourhood of Buea. Secondly, the central plateau of Ngaundere.

The southern, or coastal, belt for a width of 70 to 80 miles from the sea is covered with heavy forest in which the trees often rise to a height of 200 feet, the intervals between the trees being filled with undergrowth so dense that it is often impossible to see five yards through it. North of the Forest belt is a belt of grass country which grows thinner as it reaches further north. So what it comes to really is that all along the south-west you have a belt of very dense bush with high trees and as you go inland it opens out into grass country and scrub. As you go further north it becomes quite open until you get to Lake Chad which is practically desert-like and sandy.

As far as communications go, roads are practically non-existent with the exception of a fine motor road from Kribi to Jaunde. Kribi is near the south western extremity of the coast, and Jaunde is some 180 miles inland. The reason was that Kribi was a Port, and Jaunde was an administrative centre of importance. In the main, other routes consist of narrow paths some ten or twelve feet wide. These paths, particularly in the forest country, were admirably adapted for defensive tactics. A few determined rifles or machine guns, with which the Germans were well supplied, concealed in the bush at each bend of the path were able to cause heavy casualties and seriously to delay the advance. The forest country lent itself to ambushes to a peculiar degree, thus necessitating considerable caution on the part of an advancing column.

Only two railways existed, the Midland Railway from Duala eastwards to Eseka, which is on the way to Jaunde; and the Northern Railway from Bonaberi north to Nkongsamba. These railways were each about 100 miles long. The main administrative centres were connected by telegraph with Duala and to each other, but of course

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the telegraph lines were destroyed as the enemy retreated. Wireless telegraphy was found to be quite useless in the forest country; either the trees or the atmospheric conditions seemed to confuse the sound waves. All rivers and creeks are only navigable for a comparatively few miles inland.

The enemy's tactics were an active defence. He made skilful use of the heavy bush country to conceal prepared positions, for rear-guard actions and laying ambushes. This necessitated careful scouting on our side, and columns on the march had to be protected by numerous skirmishers in front and on the flanks. Baggage and supply columns were a source of constant anxiety to column commanders and were always most vulnerable. Transport of supplies and ammunition had to be done by porters. In some cases the lines of communication of columns were several hundred miles long, making the supply question a very difficult one.

In the first advance on Jaunde the operations failed largely owing to the difficulty of the transport question. So that the second time the advance on Jaunde was undertaken, and successfully undertaken, by General Dobell, he built a motor road first and used Ford Motor vans.

The troops engaged on both sides were West African Natives, although an Indian Battalion and a Battalion of the W.I.R. reinforced General Dobell in the latter stages of the campaign. The West African soldier is very mobile and can generally live on the country. In this campaign, however, the Germans denuded the farms of supplies during their retreat, and rations had to be provided. Columns generally consisted of a few companies of infantry with several machine guns and a proportion of artillery, but, on the whole, guns were not of much use because of this thick bush country, although their moral effect was considerable.

The strategical factors which helped the enemy were that they were working on interior lines, thus their communications were much shorter than ours. Moreover they were forewarned and forearmed as we all know, so that they had made preparations for a possible attack by an European Power. Further their administration was run on military lines, and their Intelligence was good because they knew the country. Lastly, the country was very well suited for an active defence.

The strategical factors which worked against them were, first, that the land frontier was very vulnerable while we had command of the sea. Secondly, the native population was very hostile. Lastly, they had not made themselves popular, and the natives were inclined to turn against them when war broke out.

The railway that runs over the Niger at Jebba, starts from Lagos in Nigeria and goes north to Kano, and that was a very important railway for us during the war because it brought troops and reinforcements down from Nigeria to the sea at Lagos, from whence they were shipped to Duala.

On the outbreak of the war four columns were drawn from the Nigeria Regiment and were concentrated near the German Frontier. There was the Maidugari Column under Captain Fox near Lake Chad; the Yola Column under Colonel Maclear, one of the officers

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I showed you in the group, was concentrated at Yola, the Cross River Column under Colonel Mair, was at Ikom, and the Reserve Column under myself at Calabar.

Soon after the outbreak of war it was decided to send an Anglo-French Expedition under Brigadier General C. M. Dobell, D.S.O. (now Major-General Sir Charles Dobell) against Duala, and three battalions of the Nigeria Regiment were to be held in readiness to join it. The rôle of the frontier columns was henceforth to be one of local activity only. The initial operations of three of these columns were attended by misfortune. The Maidugari Column crossed the frontier on the 25th August and encountered the enemy in an almost impregnable position at Mora on the 27th August. It suffered severe casualties and thereafter took up a position south of Mora to prevent the Garrison joining that of Garua where the Germans had rather a strong position.

The Yola Column crossed the frontier on the 25th August and had a fight near the frontier at a place called Tepe. Their attack failed and the column fell back on Yola. The column commander was killed. This column was subsequently joined by a French force under Lieut.-Colonel Brisset who had marched from the Chad area after capturing Kusseri. Colonel Brisset came from Fort Lamy, which is the French Military Headquarters in the north.

The advanced troops of the Cross River Column captured Nsanakang just over the frontier at the end of August. A few days afterwards they were attacked by a superior German force which was rushed up from Duala. After fighting with great gallantry the greater part of this detachment were killed or captured.

Owing to the extent of the theatre of operations, 306,000 square miles, or one and a half times the size of the late German Empire, and the extremely poor communications, effective control by one commander was an impossibility. Consequently the forces were divided into three groups acting to a large extent independently. These were (1) the main Allied Force under General Dobell in the south (2) the Northern Force under Brig.-General Cunliffe in the neighbourhood of Yola and (3) the Eastern Franco-Belgian Force under General Aymerich, coming from French Equatorial Africa in the east and south.

Briefly the plan of campaign was first to capture Duala by the joint naval and military operations of an Anglo-French Force under General Dobell; secondly, to invade the Cameroons by the co-operation of Anglo-French troops from the north (General Cunliffe) and, thirdly, General Aymerich's troops were to advance from the east and south and exert as much pressure as they could.

The strength of the enemy was approximately 176 Europeans and 2,000 Native Troops in addition to a large number of partially trained European civilians, while the native forces were eventually increased to about 4,000, and they had seven field guns and about 100 machine guns.

As to the strength of the Expeditionary Force, the main Force under General Dobell consisted of about 4,500 West African Native troops which were increased to about 9,500 by the end of November 1915. The Northern Force consisted of about 3,250 West African

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Troops including 750 French troops and a few guns. While the Eastern Force consisted of about 3,250 French Native troops and some Belgians, ultimately increased to 4,000.

General Dobell's transports and Naval escort arrived off Nigeria towards the end of September. He had picked up troops from French Senegal, Sierra Leone, Gambia and Gold Coast as he came.

The campaign can now be conveniently divided into two phases, the first phase from September 1914 to June 1915, and the second phase from July 1915 to February 1916.

First Phase. General Dobell's first objective was Duala. Although the entrance to the harbour had been blocked and mined, the obstructions were successfully removed by the Navy under Capt. Fuller, R.N. On the 26th September, H.M.S. "Challenger" bombarded the town, and a land demonstration was made by way of a neighbouring creek. On the 27th of September Duala and Bonaberi surrendered; thus a safe base was secured for future operations while 400 Europeans and 40,000 tons of shipping and much material were captured.

In order to consolidate the position won, the following operations were undertaken. The French troops under General Dobell advanced up the Midland Railway from Duala in the direction of Edea. General Dobell's information was that the enemy's main force had retreated along that line. At the same time a column was landed just opposite Duala on the west side of the river and pursued the enemy up the Northern Railway.

The third operation undertaken about the same time was towards Jabassi. The Wuri River leads up to Jabassi and the expedition was a joint naval and military one under Colonel Gorges.

The next objective was Edea on the Midland Railway; this was captured by the French about the end of October after some severe fighting. General Dobell now sent the main British Force under Colonel Gorges to capture Buea, which was on the foothills of the Cameroon Mountain. Buea was a rather important administrative centre, and Colonel Gorges had a Naval Force on launches which co-operated by making landings at a place called Tiko which is S.E. of Buea and at Victoria which is south of Buea. Colonel Gorges' main force advanced from Tiko, while a small subsidiary force based on the northern railway marched southwards, and Buea was captured without much difficulty.

After the capture of Buea, General Dobell put all the British troops he had at his disposal under Colonel Gorges, and ordered them to concentrate at Mujuka which is on the northern railway. Their objective was the capture of the whole of the Northern Railway. Colonel Gorges carried out his operations very successfully; he pursued the enemy to Dschang, captured the Fort at Dschang and blew it up. It was then decided to retire to the rail-head because it was difficult to keep Colonel Gorges' troops supplied with food and ammunition once they got off the railway. During these operations Colonel Mair's Cross River Column had captured Ossidinge and advanced to Tinto, thereby relieving the pressure on Gorges' left flank.

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Bombe was attacked and taken by a column co-operating with Colonel Gorges during his Buea operations. During Colonel Gorges' advance up the railway, the Germans blew up the bridge over the Nlohe River.

Early in 1915 the situation was as follows: The enemy were distributed in six main columns. The western column was at Widekum Bali and Bamenda; No. 2 Column just north of Dschang blocking the roads to Bamun and Bamenda. The Reserve column north of No. 2 was at Esu, Kentu and Bekom; the eastern column was at Dumie Station; while Marwitz was retiring in front of the French who were advancing on Lomie. The main column was east of Edea.

As far as the Allied Troops were concerned, the British troops were holding Duala, the northern railway, with outposts at Bare, Victoria and Buea. The French troops were at Edea and had a detachment at Kribi. Ships and armed craft had effected a blockade along the coast and were patrolling all Ports and navigable waterways. General Aymerich's troops were 400 miles away from General Dobell's troops, but had just begun to make their presence felt.

On the 5th January the Germans made a most determined attack on the French at Edea. The attack was made by about 800 troops but was beaten off with a loss of 200 killed and wounded.

As a result of a conference which was held at Duala in February it was decided to prosecute the Northern Campaign actively and attack Garua; for this purpose all French troops in the north were placed under General Cunliffe. Garua had been turned into a strongly intrenched position, protected by numerous obstacles and wire entanglements.

During this time the progress of the French troops in the east had, in some cases, been rather rapid. I will now explain what they had been doing. The French were in four columns. These yellow lines represent the French columns, on the north was No. 1 Column under Colonel Morisson, operating in the Lobaye area; No. 2 under Colonel Hutin, was operating on the Sangha River; No. 3 under Colonel Le Meillour was on the Eastern Frontier of Riomuni and No. 4 under Colonel Miquelard, was directed on Akoafim. No. 1 Column advanced as far as Baturi and they actually captured it. At this time their line of communications—which had become dangerously extended—were heavily attacked, forcing them to fall back on to the line of the River Kadei. Colonel Hutin advanced up the Sangha River and relieved Wesso towards the end of 1914, he then pushed a column up the river to link up with Morisson at Nola; the Germans from Molundu now attacked his communications placing him in a dangerous position. However the Belgians sent a small force up the river which drove the Germans back. Hutin had to retire to Wesso to consolidate his position. No. 4 Column advanced without much opposition and was a short way north of the frontier early in 1915. No. 3 Column advanced along the Eastern Frontier of Rio Muni without much opposition.

On the 12th March the Governor General of French Equatorial Africa came to Duala and a conference was held with General Dobell.

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At this conference it was decided to make a general advance on Jaunde which had now become the German Administrative Headquarters. General Dobell was not in favour of making an advance on Jaunde because he did not consider himself strong enough at the moment, moreover the French were so far distant (they were between 300 and 400 miles away) that it was not likely that they would be able to co-operate effectively. A further argument against undertaking operations on a big scale was that the rainy season was due to start about the end of May, and General Dobell did not think there would be time to capture Jaunde before the rains set in. The French, however, insisted on the importance of capturing Jaunde if possible, so General Dobell agreed to do what he could. A British Column under Lt.-Col. Haywood was despatched along the Edea—Jaunde road to establish itself at Wumbirgas; while a French column under Colonel Meshet advanced along the railway from Edea to Eseka. These two columns successfully reached their objectives after some severe fighting. They were then combined under Colonel Mayer who was commanding the French Contingent of General Dobell's Force. Colonel Mayer transferred Colonel Mechet's Column from Eseka to Wumbiagas, and himself took command of the combined columns and advanced on Jaunde. The advance failed, partly owing to transport difficulties. There were really not enough troops or carriers, and the lines of communication were very vulnerable. The Germans kept on cutting the lines of communication, and some convoys of food were lost. General Dobell then heard that the French Eastern Columns had not been able to advance as rapidly as had been hoped, and that it was impossible for them to exert any pressure on Jaunde from the east. Colonel Mayer was therefore ordered to retire to Ngwe. This brings us to the end of June.

During this time in the north General Cunliffe had made his dispositions for attacking Garua. He found the place was very strongly entrenched and started sapping up to it. He bombarded Garua heavily from the north and west, and eventually Garua surrendered. I will just read you a short extract from General Cunliffe's Despatch about Garua: "The night of the 30th and 31st May 1915 found the bulk of the Allied Forces entrenched about 3,000 to 3,500 yards from the German position. From the 31st May to the 10th June we pushed forward our advance, entrenching under cover of darkness, until, on the 10th June, we had established a line of trenches, on a front of about 400 yards, within 1,000 yards of the main fort and with an efficient service of communication trenches to the rear. The question of water supply was one of considerable difficulty, water having to be carried to the trenches in pots for two miles. On the night of the 9th and 10th June the enemy made an attempt to break out to the south and we met that by a British Infantry attack and they were driven back. A second attempt was made by an Infantry Company and a Mounted Infantry Company, but the Benue River which runs south of Garua was in flood, and, although some of the more fortunate native rank and file succeeded, by discarding their uniforms and other things, in making their escape, by far the larger number were drowned. On the 10th June Garua surrendered unconditionally when 37 Europeans, 212 Native Ranks,

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five guns, ten maxims, a number of rifles and much small arm ammunition were captured."

Second Phase. Now we come to the second phase of the campaign, from July 1915 to February 1916. From July to Sept. owing to the rains, and the necessity for re-organising and resting the troops, no operations of importance were carried out except reconnaissances along the Njong and Campo Rivers, and from Ngwe. The Njong River falls into the sea south of Edea. The Campo River runs along the northern frontier of Rio Muni. Ngwe was our furthest advanced post east of Edea.

On the 8th and 9th September General Cunliffe made three attempts to capture Mora, but these failed owing to lack of time and artillery. Mora was a very strong position; it was on a precipitous mountain rising out of the Plain, it was a very difficult place to climb up, and a very difficult place to attack altogether. Mora, as a matter of fact, was never captured; it held out right to the end of the campaign, and surrendered in February 1916.

On the 25th August a conference was held at Duala between the Governor General of French Equatorial Africa, General Dobell, and General Aymerich. At this conference the plan was decided on by which the Cameroons were finally conquered. This plan was as follows: General Aymerich, whose troops were now established at Bertua and Dumie, was to co-operate in an advance on Jaunde as before while the two columns under Colonels Le Meillour and Miquelard were to advance north and exert as much pressure as they could. A small column was to advance from the coast up the Campo River. General Cunliffe was to push south from Garua, while a column under Colonel Cotton, who was under Genl. Dobell's Command, was to proceed north from Bare and gain touch with the Cross River Column at Fumban.

In October the British advance started. A column under myself advanced from Ngwe to Wumbiagas. We established supply depôts along this road and made it fit for motor traffic. The French from Edea advanced up the railway to Eseka. They repaired the railway, collected the rolling-stock, and established supply depôts.

The enemy's main force was now collected about Jaunde. He had small detachments along the Western Frontier, and on the roads leading south from Garua to Jaunde he was also putting up as much opposition as possible to Aymerich's French Column. During November Colonel Gorges, who was in command of the main British Force, advancing along the road from Wumbagas to Jaunde, had a good deal of opposition, which he overcame in the following way. One column worked on each flank, thus threatening the enemy's line of retreat and causing them to abandon most of their positions, some of which were very strong. The French advancing from Ejeka to Mangeles had severe opposition. General Cunliffe advancing from Garua captured Ngaundere with very little trouble. He then came up against the Banjo position, some 250 miles south-west of Garua. The Germans had made a very strong entrenched camp at Banjo, and some of the hardest fighting we had in the Cameroons Campaign took place at Banjo.

I will read you a short extract from General Cunliffe's Despatch

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about it. "The Banjo Mountain is a single feature rising 1,200 ft. above the surrounding country which is much broken by small hills. The slopes of the Mountain are very steep and covered with large boulders. Every practicable commanding point had been strengthened by a small fort. On the summits immense reservoirs for water had been constructed. Brick houses with glazed windows had been erected and they had some forty tons of grain and a lot of cattle. By the 2nd November we had established five companies of Infantry in commanding positions and disposed of the mounted infantry in a wide circle to give notice of any advance of the enemy. The advance was to be supported by two guns on the north, north-west and south. The attack was attempted at daybreak on the 4th November and until 9 a.m. that morning the Mountain was shrouded in thick fog which enabled our troops to make considerable progress, but which prevented the different units from mutually assisting each other or benefitting during their advance by covering fire from the guns. Under cover of the fog Captain Smythe succeeded in leading a Company right up to the summit. Here, however, they came under a cross fire from several directions and Captain Smythe, one of our most able and dashing Company Commanders having been killed, the Company was forced back to the foot of the hill. During the night of the 4th and 5th November the enemy exploded a large number of dynamite bombs, to our Native troops a trying style of warfare. Our men fought their way upwards until by dusk on the 5th November they were within 100 yards of the top. At 7 p.m. on the 5th November a violent thunder storm broke and at daybreak on the 6th the summit was carried. It was found that during the storm the enemy had broken up into small parties and crept down the Mountain. The majority we captured later. This action may be justly described as one of the most arduous ever fought by Native African troops."

On the 1st of January Colonel Gorges' Force occupied Jaunde. Now I think it is rather noteworthy how well the whole of the operations were timed, considering the difficulty of communications, because between the 1st and the 8th January the three main Allied groups met at Jaunde. The enemy retreated in a southerly direction and were evidently making for Rio Muni. General Dobell now decided to withdraw all the British troops and to leave General Aymerich in charge of the operations for preventing the Germans escaping into Muni. General Aymerich reinforced the Campo Column with a view to moving up the Campo River and cutting off the German retreat in that direction. Morisson's and Hutin's Columns moved south from Jaunde directed on the Campo River, while Colonel Le Meillour in the south was trying to bring the enemy to action and keep him closely engaged. However, unfortunately, the Campo Column did not move as fast as was expected, and the main body of the enemy got away into Muni and were interned there. The Garrison of Mora capitulated on the 17th February, after hearing that the Germans had retired into Muni and that the Cameroons had been evacuated, then the Germans were, by arrangement with the Spanish Government, taken off to Fernando Po, and eventually sent to Spain. (Loud and continued Applause).

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THE CHAIRMAN: Would anybody like to ask the Lecturer any questions? There is one question I would like to ask, and that is what exactly the enemy consisted of, whether the Germans had a large proportion of black troops or not.

COL. HAYWOOD: Well, Sir, practically all the German troops were black, but they had a large number of white Officers with their black troops, and they had a great many people like traders and crews off their ships which had been abandoned up the creeks. They were all roped in; I think all of them had a certain amount of military training, a great many of them were of the German Reserve, and they all came into the picture before the end of the war.

THE CHAIRMAN: Did our troops have much trouble with disease and that sort of thing?

COL. HAYWOOD: Yes, on one or two occasions, particularly during the first advance on Jaunde, when there was a great deal of rain; it was the rainy season, and the men got dysentery. I have not got the figures here and I cannot remember off-hand, but I think one column lost about one-third of its strength from dysentery.

THE CHAIRMAN: Was there much fever?

COL. HAYWOOD: Yes, there was a good deal of fever, but most of the trouble was dysentery.

THE CHAIRMAN: Well, Ladies and Gentlemen, I am sure you will agree with me that it has been a most interesting Lecture, especially to myself because, as I said before, I knew so little of this campaign. But, interesting as it has been, I have one criticism to make, and that is that I think we should have liked to hear a little more about the Lecturer's own personal adventures. (Applause). I think he has been too modest to tell us about them, but I may tell you that he has been through a great number of adventures, and had some hairbreadth escapes, both in the country that he has been talking about and in other countries. I hope that, perhaps on a future occasion, he will come down again and tell us more about them, and leave his modesty behind. The Germans did not leave him alone even when he left the country; they torpedoed him on his way home to England, and he had a very narrow escape. I think you will agree with me that the fact that he did escape is a gain, not only to him but to us; we should not have had the privilege otherwise of listening to him to-night. It only remains for me to make a proposal which I am sure you will all support, and that is that we offer a hearty vote of thanks to the Lecturer for his most interesting Lecture. (Loud and continued Applause).

COL. HAYWOOD: Thank you very much.

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FURTHER NOTES ON RANGING WITH AEROPLANE OBSERVATION.

BY CAPT. R. HILTON, M.C., D.F.C., R.G.A.

IN the April number of the "Journal" I suggested a scheme for quickening up aeroplane ranging, without radically changing our present system. The scheme had no claims to perfection, but was put forward in order to arouse interest and discussion on this important artillery subject. In fact it was a sort of "Aunt Sally." Fortunately it has been sufficiently interesting to arouse valuable and much appreciated criticism, both in the Journal and in personal conversation, so some further remarks in reply to the points raised may be of interest.

Most of the criticism follows similar lines to Major Christian's article in the December number, so let us consider the difficulties pointed out by him. They may be divided into two lots—those experienced at the aeroplane end and battery end respectively.

Major Christian writes, he states, from the point of view of a 9·2″ How. or 8″ How. Battery Commander. My suggestion was put forward rather from the point of view of the pilot who is working with the battery—who may be working in fact with almost any nature of battery. From the latter point of view, taking fully into consideration normal war conditions on a "lively" front, I maintain that the scheme is perfectly feasible as far as the aeroplane is concerned.

The objections put forward which affect the pilot are (1) "Archies", (2) hostile aircraft, (3) clouds.

(1). "Archies." An aeroplane engaged on a shoot must expect to be almost continuously under A.A. fire. The idea of allowing the pilot to stop the shoot in order to dodge A.A. fire would be most unsound. Not only is it quite possible to dodge A.A. fire and carry out a shoot simultaneously, but it is essential to do so. Otherwise "Archie" would be assuming an importance by no means justified by his deadliness, and very few shoots would be carried out.

(2). Hostile Aircraft. Interference by H.A. would put a stop to the sending down of observations. A simple way out of this difficulty would be to make a rule that the battery stopped firing on failing to receive observations every ten seconds, and did not commence again till called up and sent another "G".

(3). Clouds. The above rule would also cover the case when observation is temporarily prevented by a bank of clouds. Similarly wireless trouble or any other minor difficulty which might necessitate a few minutes pause could be dealt with by this rule. The problem of observing in weather when thin wisps of clouds keep obscuring

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the target for a few seconds at irregular intervals would be no harder than it is under the present system. In fact it would be much easier, for under the present system one has to judge where the moving cloud will be in forty or fifty seconds, whereas in the suggested scheme one would only have to judge where it would be in ten seconds, and place oneself accordingly.

From the aerial point of view the observation of rounds at ten seconds interval would make things much easier for the pilot, than they are with the sometimes lengthy shoots of the present system.

Throughout a shoot the minds of pilot and observer must be occupied in other matters besides the shoot. The observer has to look out for enemy aircraft, and the pilot often has to as well, if the observer is a beginner. In addition the pilot's mind is subconciously occupied with the running of his engine etc. Consequently every minute of a shoot entails considerable mental strain, and if a battery can be ranged in twenty minutes by some new method instead of forty by the present one, the value of the aeroplane co-operation will be doubled. It is a well known fact that good shoots are generally quick shoots, and vice versa. If a pilot is kept hanging about over the line, his mind is bound to become distracted and the shoot will be a failure.

With regard to the difficulties at the battery, it must be confessed that these are much more serious than those in the air. In stating that one round every forty seconds was not an excessive speed, I was assuming that progress in heavy artillery construction will soon permit a greater rate of fire than is possible with heavier natures of the present day. Heavy artillery in the field is comparatively in its infancy at present. 9·2″ guns in coast defence can fire once every twenty-five seconds. It seems reasonable to hope that heavy howitzers may soon be evolved, which will be able to manage one round in forty seconds. But even so, Major Christian quite rightly says that B.C's cannot be expected to deal with observations, and get their orders through to the guns, at the rate of one round in ten seconds. The following modification of the original suggestion would obviate this very serious difficulty:—

On receipt of first "G" the battery fires one round battery fire at ten seconds interval. The pilot sends down a separate correction for each round within ten seconds of its fall. *He must invariably send some observation*—e.g. "not observed" whenever necessary.

Exactly two minutes after No. 1 gun fired it fires again, followed by one round from each gun at ten seconds interval. One round battery fire at ten seconds interval is repeated every two minutes, each gun firing by stop watch, and taking No. 1 gun's first round as "zero" for the whole shoot.

For example take the case of a 9·2″ How. Battery of 4 guns, and assume time of flight to be 40 seconds.

				The correction is sent at
No. 1 gun fires at	"zero".	The round falls at	40 secs.	or before 50 secs.
,, 2 ,,	10	,, ,,	50 ,,	,, 1 min.
,, 3 ,,	20	,, ,,	1 min.	,, 1 ,, 10 secs.
,, 4 ,,	30	,, ,,	1 ,, 10 s.	,, 1 ,, 20 ,,

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No. 1 gun does not have to fire again till 2.00 minutes, so the B.C. has an interval of 40 seconds to think over the four observations, in addition to ten seconds between each round. The guns do not have to exceed the rate of one round per two minutes. Yet this method gives four observed rounds every two minutes, as compared to one observed round per minute obtained with great exertion under the present system.

In the case of 18-pounders the same rule could hold good, and would result in six rounds every two minutes when working with a six gun battery. Even with three or four gun batteries the rapidity of the 18-pounder would always make it possible to fire six rounds with ten seconds intervals. The method could be used equally well by all natures, therefore, and 18-pounder batteries would at last find aeroplane ranging sufficiently quick to be worth using.

In the following table the top row (a) refers to four gun batteries of all natures except 18-pounder. The bottom row (b) refers to 18-pdr. batteries firing six rounds every two minutes. The numbers give the interval in seconds which the B.C. has, before the next round of battery fire.

Time of flight:—	10	20	30	40	50	60
(a) 4 rounds per 2 min:—	70	60	50	40	30	20
(b) 6 rounds per 2 min:—	50	40	30	20		

It will be seen that the B.C. will always have at least 20 seconds, since the time of flight of howitzers rarely exceeds 60 seconds or 18-pounders 40 seconds. Finally, he need be in no confusion as to which gun particular observations referred, since pilots would be strictly trained to send observations promptly every ten seconds. A knowledge of the time of flight and a stop-watch would leave the B.C. in no doubt as to which gun each observation belonged.

On the contrary, it is this difficulty of unobserved rounds which precludes the use of such a system as Major Christian suggests—namely two rounds fired at a close interval on receipt of each "G". This system was actually tried during the war, but had to be abandoned for this reason. If one of the two rounds is unobserved it is impossible to say which gun fired the observed one, so both rounds have to be wasted. For this reason it is essential to have a definite interval between rounds—an interval allowing the pilot to send seperate observations after the fall of each round. 10 seconds is the minimum possible interval, but on the other hand it wastes no time.

In estimating the time required to range a four gun battery—allowing ten rounds per gun—Major Christian has in error made this time 12 minutes. It should really be 23 minutes (approx.) as compared with twenty minutes required by the system suggested above.

It has been said by some officers, that it is neither desirable nor necessary to quicken up aeroplane ranging, and that the present rate works very well, and is quite fast enough. Surely this is a mistaken idea. Quicker shoots mean that one aeroplane can do the work now done by two, and can do it with less wear and tear of personnel. Therefore squadrons short of serviceable machines and of pilots, can get shoots done which would otherwise have to be left undone. Squadrons will be able to get more photography and artillery (flash

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location) patrols carried out. The counter-battery situation will be correspondingly improved. As it was, far too little was done in the way of flash location patrols owing to shortage of machines. This important work often had to be carried out by a machine which was also engaged in a shoot—a most unsatisfactory arrangement.

Finally, bombing and "ground strafing" are continually growing in importance, particularly in open warfare. It often happens—and will happen more and more in future—that in times of stress on a sector of the front, corps squadrons have to send nearly all their machines on this work, leaving two or three to do artillery work. The more they can get done the less the artillery programme will suffer.

It is essential that aeroplane ranging should be quickened up. The system which I originally proposed, and again suggest in the above modified form is probably still full of flaws.

But its main basis is the idea of saving time by "not waiting for each shell to arrive" as we do at present. Perhaps by pulling these suggestions to pieces a sound system may be built up, founded on the elimination of the "time of flight" from forming so large a factor in the duration of shoots.

Further Notes on Ranging with Aeroplane Observation.

By Capt. & Bt. Major H. C. Harrison, D.S.O.,
Royal Marine Artillery.

THE remarks by Major Christian on "Ranging with Aeroplane Observation" in the December number of the Journal certainly furnish a much needed criticism to a contribution on the same subject which appeared in April, but at the same time Major Christian's own suggestions do not by any means solve the fundamental problems of the matter.

It must be remembered that a destructive shoot to be effective demands the three following conditions:—

1. That, owing to the inherent error of a gun, a very large number of rounds are required.
2. That, by means of ranging, the M.P.I. of these rounds must be placed on the target.
3. That, throughout the subsequent fire for effect, the M.P.I. must be retained on the target.

The aeroplane can only assist the gunner in the two latter cases.

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With regard to the actual ranging, the present writer maintains that "single round" ranging is the best. Major Christian's scheme of firing pairs of rounds at two secs. interval has been given exhaustive trials, as indeed have many other suggested methods, and experience has always shown that the original method is both quickest and surest.

The following are some well known reasons against any methods of ranging other than "single round" ranging:—

1. A blind round from one gun will render the whole observation valueless.

2. A missfire from one gun would confuse an observer expecting two rounds to fall.

3. The method could not readily be made universally applicable. The procedure for "M.Q.N.F." and "A.N.F." and prearranged shoots should be identical so far as the aeroplane is concerned, and in the two former cases a 'plane might not know whether it was about to shoot with a 1, 2, 3, or 4-gun battery.

4. The round from a new gun, fired two seconds after a round from a worn gun might readily be observed to burst before it.

No, let us advocate during *ranging* the maximum of carefulness and sureness combined with the minimum of complication and delay, and let us realise that the essential feature of this part of the destructive shoot lies in getting the "line" of the guns absolutely correct. However accurately we obtain the elevation during ranging, there is little doubt that the M.P.I. will shift off the target during the fire for effect—due to variations in atmospheric conditions etc.—but that the line will not be altered to anything like the same extent.

The existing methods of ranging demand that the elevation shall be nearly correct in order that indications as to the correctness of the line shall be afforded. Thus, accurate ranging for line does not impair ranging for elevation.

Forty rounds or less may readily serve to range a 4-gun battery: we now come to the question of the effectiveness of the remaining 260 rounds which may have been allotted for the destructive shoot. Under present conditions, the best check that the B.C. can hope for is for a 'plane to occasionally watch the fire and report "M.O.K." by way of encouragement. We know how the variable meteorological conditions must be affecting our mean point of impact. Are we doing our best to check the positions of this M.P.I. without unduly detaining the 'plane?

The writer therefore suggests that our immediate necessity in this type of shoot is the development of some scheme for checking the M.P.I. *for elevation* during fire for effect, and the following method has proved effective on an experimental range and on at least two Corps fronts in France:—

(For the purposes of example, a 4-gun battery is instanced).

Let the arrangement be that fire for effect is always fired as rounds of battery fire, 5 seconds, every minute: this enables an observer to witness all four rounds drop (since he can observe continuously for 15 seconds) and to see each round of battery fire

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(since he can regain his "position of observation" every minute). It is, moreover, an accepted method of fire.

Let him record in writing by means of the letters "S" (short) and "O" (over) the fall of each round: it would be too much to ask him to "clock code" each round, although French observers do it, and ranging will have shown him his line of fire on the ground.

At the end of, say, six rounds of battery fire let him stop the fire of the battery, and send to the B.C. a signal consisting of four figures, each figure representing the number of "overs" each gun had obtained. Thus "5320" would mean that of the four guns firing, No. 1 had obtained 5 + and 1 −, No. 2 gun 3 + and 3 −, No. 3 gun 2 + and 4 −, No. 4 gun 6 −. In the compilation of this report, the airman would discard altogether an incomplete group (thus eliminating any possible error due to blinds, missfires, or forgetfulness).

Let the battery commander then make such alterations as are indicated, using the accepted French method when observing from a station on the line of fire, i.e., by correcting No. 4 by the amount of the short bracket, No. 3 by one-sixth of the short bracket, and No. 1 by one-third of the short bracket.

Having applied such corrections, let the B.C. again put out "V" and resume his fire for effect, the 'plane returning from time to time (having ranged a second battery on a different target, or in accordance with its other duties) to check the fire, synchronising its flight by means of the gun flashes and recording and reporting its observations as before.

By this means, the battery commander will have obtained, in some 9 or 10 minutes, the "concentrated essence" of 24 or more rounds, and will be able to remedy any false deductions during ranging for any individual gun, and any displacement of M.P.I. due to alteration of meteor.

Such a method may at first seem revolutionary: one is inclined to say that it asks too much of an observer, but remember that "S.S. 131" already demands that the observer, during fire for effect, shall report any individual gun whose M.P.I. appears to be displaced from the target, and what observer—from an aeroplane or from the ground—would conscienciously attempt to do this without recording the rounds as they fell?

At all events, such a development would appear to be a step in the right direction, for it must be remembered that the modern howitzer cannot be treated like a garden hose—trained on to a flower bed and left to play for the rest of the afternoon. The hostile battery is *not* destroyed when ranging is completed.

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TRENCH MORTARS IN THE GREAT WAR.

By Major N. Hudson, D.S.O., *pac.*, R.A.

PART I.

FOR the past two centuries Mortars have been employed in the British service for siege warfare. They were used extensively in the Crimea, and it is interesting to note that the types used in this campaign far exceeded in weight and calibre any of the Trench Mortars used in the European War. In some of our land fortresses in India, mortars have formed a part of the armament up to comparatively recent times, and their employment is well within the memory of many senior officers of the Royal Regiment.

The open nature of the fighting in the South African War produced a school of military thought which ignored the study of weapons of close combat, and from 1900 up to the outbreak of the Great War, mortars were forgotten or merely regarded as curious relics of a bygone era.

The mortar proper was a short, smooth bore piece of ordnance which projected a spherical bomb at high angles.

The elevation was usually fixed at or about 45° and variation in range was effected by adjusting the weight of propellant charge from round to round. They were found most effective against fortifications on account of the steep angles of descent, and great shell power of the bombs.

The Trench Mortar may be described as a short range bomb thrower possessing the following characteristics:—

1. Cheapness both as regards the trench mortar and its ammunition.
2. Great shell power and destructive effect against earthworks, obstacles, etc.
3. Simplicity, facilitating rapid training of personnel.
4. Lightness in comparison with the weight of projectile fired.
5. High trajectory fire, enabling the mortar to be fired from deep cover against trench targets.

Trench Mortars were probably first used extensively by the Japanese in the siege of Port Arthur. Their employment was contemplated by the Germans some years before the outbreak of war, their heavy and medium mortars were organized in 1914 and played a part in the capture of the fortresses, Liege and Maubeuge.

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Minenwerfer were first encountered by our troops when the B.E.F. took up their line in Flanders after leaving the Aisne when the effects of their fire on our front line trenches caused our military authorities to consider the question of employment of similar weapons by ourselves. Moreover it soon became evident, owing to the enormous strain on our very inadequate resources as regards artillery equipment and ammunition, that some simpler and less costly means must be provided in order to relieve a proportion of our guns in the task of bombarding the enemy's front line system.

The means adopted was the Trench Mortar; and although the personnel were maintained always at the lowest possible limits, and the batteries faced with innumerable difficulties; they more than proved their value in the great offensives, in holding the line, and in our final advance prior to the Armistice.

About November 1914, experiments were commenced by the British, French and Belgians to produce Trench Mortars. The early types were mostly crude, inaccurate, and dangerous; the relative safety of the T.M. position and target, being often open to question; and the designs were also varied and numerous.

The most important invention in this connection was made late in 1914 by Sir W. Stokes, to whom we are indebted for the wonderfully simple and efficient system of firing employed by our Medium and Light Trench Mortars which will be described later.

In 1915 it was decided to increase the numbers of our Trench Mortars and by the beginning of 1916 some 200 Heavy, 1200 Medium, and 2500 Light Trench Mortars were available.

The following April three types were approved as Heavy, Medium, and Light; and the organization of the personnel was definitely laid down by G.H.Q. France.

The organization although improved later in the War (1917) can never be regarded as complete, and the small personnel allowed, rendered the Batteries dependent to a large extent on neighbouring formations, for transport, ammunition fatigues, digging parties, etc.

Before the supply of T.Ms. in large numbers materialized, the effect of employing a few isolated T.M. Batteries on a large front was usually to concentrate the fire of the numerous and powerful minenwerfer against them. This, coupled with their inability to function without the assistance of other troops did not tend to make their appearance popular.

As a direct result the personnel (also supplied by local units) was inclined to suffer; and the attitude of some of the Artillery and Infantry commanders when asked to supply personnel was rather that of "Will you take my award—or go to T.M's" nor can it be regarded as an unnatural one under the circumstances.

It is not proposed in this article to describe the equipment of the various T.M's in much detail. The principal features of interest will be found in Table I. In addition to this it will be necessary to state the characteristics which the mortars were designed to fulfil, and to give a brief outline of the designs themselves.

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TABLE I.

DETAILS OF VARIOUS TRENCH MORTARS.

Type.	Calibre.	Total weight.	Projectile.		Range Yards.		Rate of Fire.		Craters.		Remarks.
	inches.	pounds.	Type.	Weight lbs.	Max.	Min.	Per Hour.	Per Min.	Feet. Diam.	Feet. Depth.	
Heavy.	9·45	8500	Cylindrical steel bomb with domed ends and fins in rear.	152	1140	600	10	—	25	11	Range increased to 2300 yds in 1917. Long Mortar introduced.
Medium.	2	590	Cast iron spherical bomb on steel stick.	52½	540	100	30	—	14	5	Superseded by 6 in. Trench Mortar in 1917.
Medium.	6	875	Cast iron cylindrical bomb with fins in rear.	47¾	1800	100	—	6	14	5	
Light.	3	100	Cylindrical bomb with container taking a 12 bore sporting cartridge in rear.	10¾	430	116	—	20	2½	1½	Range increased to 800 yds. max. in 1917, and reduced to 95 min.

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Characteristics.

Heavy Trench Mortar.

An immobile weapon of position. Its primary object being the demolition of material.

Medium Trench Mortar.

A weapon of position unfitted to accompany infantry in the actual assault* though it should be moved up as soon as possible. Its primary objects being the demolition of wire, and destruction of earthworks.

Light Trench Mortar.

A mobile weapon with a high rate of fire especially suitable for accompanying and supporting infantry in the assault.

Its primary use is against personnel and machine guns under light cover; its effect on material is small in comparison with the other types.

Among the great variety of weapons which were to be found on the battle fields of France and Belgium the Trench Mortar bears the nearest resemblance to the Howitzer. Although the resemblance is by no means close, the comparison is interesting and forms a means of showing why Trench Mortars were employed so extensively.

A very general description will now be given of the principles which governed Trench Mortar design, and occasional comparison with Howitzers and Field guns of approximately similar calibre will be made.

The design of the Heavy T.M. is French, the remainder are British.

The Piece.

All British Trench Mortars were muzzle loading, and smooth bore; pivoted about the breech, and supported by a band about half way up the mortar. With the exception of the 2-inch, all trench mortars consisted of thin steel tubes designed to take the projectile, capable only of standing very small pressures.

The 2-inch T.M. is interesting as an example of a "stick bomb" type. The mortar consisted of a stout steel tube capable of withstanding a pressure of about 7 tons, the bomb consisted of a sphere of cast iron attached to a steel tail, the tail only entering the bore.

Table III compares the weights of T.M. and its projectiles with those of the Howitzers and Field guns.

Carriages.

No recoil arrangements are provided on any T.M. mounting. From Table II it will be observed that the Momentum on Recoil is considerable, hence strong beds or platforms are essential.

All T.M's fire between angles of elevation of about 45° and 75° consequently the mountings are designed to give these elevations. They must be easily dismantled into portable loads, be simple and not

* This was modified in 1918 when 6-inch Medium Mortars on locally constructed mobile carriages were used with infantry in the assault.

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TABLE II.

Comparison Weight of Propellant.

Gun or Trench Mortar.	Charge (Ounces.)	Weight of Projectile (lbs.).	1 oz. Charge Propels (approximately).	Or each lb. of Shell is Propelled by (approximately).
9.2" B.L. How.	380	290	¾ lb.	1¼ oz.
9·45" T.M.	17	152	9 lbs.	1/10 oz.
6" B.L. How.	75½	100	1½ lbs.	¾ oz.
2" T.M.	3½	52½	14¾ lbs.	1/14 oz.
6" T.M.	4	47¼	12 lbs.	1/12 oz.
18-pr. Q.F. Gun.	23	18½	¾ lb.	1¼ oz.
3" Stokes T.M.	1	10¾	10¾ lbs.	1/11 oz.

TABLE III.

Gun or Mortar.	H.E. in Projectile.			Cost.		Weight (approximately).	Personnel for 4 Guns.	
	Weight Shell (lbs.).	Weight H.E. (lbs.).	%	Gun.	1 Round.		Officers.	Other Ranks.
9·2" B.L. How.	290	44	15	£6,000	£20	15½ tons	6	158
9·45" T.M.	152	56	27	£200	£8 3 0	1½ tons	3	66
6" B.L. How.	100	14	14	£2,000	£10 0 0	5 tons	6	158
2" T.M.	52½	12½	24	£50	£1 16 0	500 lbs.	2	23
6" T.M.	47¼	12½	25	£12	15s.	375 lbs.	2	23
18-pr. Q.F.	18	13/16	4½	£900	£1 3 0	25 cwt.	4	134
3" Stokes T.M.	10¾	2¼	21	£18	17s. 6d.	100 lbs.	2	23

The above figures are approximate, and were taken for the period 1916 to 1917.

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affected by mud. The means of laying for elevation is in all cases by clinometer, and for line by compass, map, or plumbline, used in connection with the means for registering traverse.

Here the general similarity ends and the mountings must be dealt with separately.

The Heavy T.M. is pivoted by breech trunnions in a carriage which has toothed elevating arcs.

The carriage revolves on a graduated metal platform giving 270° of traverse, and the metal platform is clamped to a wooden platform which in turn is laid on a wooden sub-bed except in very hard ground.

The 2-inch Medium mounting consists of a light steel frame supporting a collar which is clamped to the piece, the frame is provided with slow motion screws for final adjustment of both elevation and traverse. The frame is attached to a wooden bed on which the breech of the mortar is also pivoted.

The 6-inch T.M. has a peculiar arrangement of 3 steel guys holding a collar which forms a part of the mortar. The 3 guys are anchored to a wooden bed which contains a socket for the reception of the breech of the mortar.

Laying for both elevation and line is effected by manipulating the 3 guys and a special type of clinometer reading both line and elevation. The system is not mathematically accurate and has been described as an injudicious mixture of horizontal and vertical motion.

The light T.M. is supported by a collar held in a light "A" frame of bicycle tubing capable of being elevated and carrying a gear giving a small angle of traverse, the breech of the T.M. is separately supported by a steel base plate.

Ammunition Bombs.

The trench mortar throws a heavy projectile with a small propellant charge, consequently the velocities, accelerations, and pressures, are small compared to those of Howitzers and Field guns.

In T.M. bomb design therefore the weight of the H.E. content can be made to bear a much higher relation to the total weight of projectile, than is possible in the case of Howitzer shell.

Table III gives a comparison, and shows why a T.M. bomb is more destructive in its effect than a howitzer shell of similar weight.

The metal of which the bombs are made is thin steel, in the case of the Heavy T.M. which fires a cylindrical bomb with domed ends having fins in rear to secure steadiness of flight.

In the medium T.M's cast iron is used both in the case of the 2-inch T.M. stick bomb, and the cylindrical bomb with fins used in the 6-inch T.M. The fragmentation given by cast iron is probably the best known for wire cutting effect.

The Light T.M. fired a bomb consisting of a length of 3-inch water pipe closed by two steel ends called guides, which screwed into the pipe. To the forward guide the fuze is attached and to the rear guide a cylindrical tube perforated with holes is attached, this container takes an ordinary 12-bore sporting cartridge.

No arrangements were made for keeping the bomb steady in flight.

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Fuzes.

It would be quite impossible in this article to attempt to describe the various T.M. fuzes in any but a most general manner.

Time fuzes were originally used for all T.M's and were eventually entirely discarded, the low accelerations especially when using the smallest T.M. charges, necessitated the arming arrangements being of a most sensitive nature, and safety pins, to be removed only after or immediately before loading, had to be used. The percussion fuzes were of two types, delay and instantaneous, the former for demolition of earth works, the latter for use against wire, personnel, etc.

The heavy and medium T.M's used cheap improvised types of fuzes consisting of a cast iron body in which a ·303 S.A. cartridge case was held, base forward, with a metal point fixed just in front of the cartridge cap. For rapid output the design was ideal, for safety it left much to be desired.

The light T.M. employed a type of fuze constructed to function on impact in any position the bomb might fall; the enemy employed a fuze having similar properties.

Propellant Charges.

Table II gives a comparison with Howitzers showing what extremely small propellant charges were used in mortars.

No gunner likes using the No. 1 charge in his Howitzer, and considering that the No. 1 charge in any Field Howitzer is far greater than the highest charge used in a T.M. it is not surprising that great difficulty was experienced in producing anything of a satisfactory nature for this purpose.

Great difficulty was experienced in getting modern gelatinized propellants to burn with any regularity at the extremely low pressures and loading densities. Added to this was the almost impossible task of keeping the charges dry under conditions of trench storage.

The mortars themselves were apt to collect water in the bore, into which the primed end of the charge would be dropped on loading.

Cordite was used by us in the Heavy and Medium T.M's and sporting Ballistite in the Light T.M.

Means of Ignition.

The heavy and medium types were fired by means of a special S.A. cartridge containing black powder, fired in a rifle, or later a simple percussion, mechanism.

The means of firing in the light T.M. was the remarkable method, alluded to before, discovered by Sir W. Stokes.

This consisted of a striker fixed in the breech end of the mortar centred about the axis of the piece, the striker contained a central nipple on its upper face. On dropping the bomb down the muzzle of the T.M., the cap of the 12 bore cartridge held centrally in the container fixed to the base of the bomb, impinged on the nipple of the striker, firing the cartridge.

This enabled a rate of fire of 20 rounds per minute to be easily maintained, as the T.M. fired as fast as the bombs could be loaded at the muzzle.

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Accuracy.

Table IIIA gives a comparison of the 50% zones of T.M's and Howitzers, taken from experiments carried out in France.

TABLE IIIA.

COMPARISON OF 50% ZONES OF HOWITZERS AND TRENCH MORTARS.

HEAVY.

Howitzer.	T. M.	Range.	Length.	Breadth.
9·2	—	8,500	80	21
—	9·45	1,000	80	35

MEDIUM.

Howitzer.	T. M.	Range.	Length.	Breadth.
6"	—	8,500	45	10
—	6"	1,000	40	7
—	2"	500	29	13

LIGHT.

Howitzer.	T. M.	Range.	Length.	Breadth.
4.5	—	5,000	47	13
—	3" Stokes.	400	26	10

Cost.

Table III shows the comparative cost of T.M's, Howitzers and their ammunition. It is important to observe that in considering the design of any trench mortar, the cost of the ammunition is the real factor of importance, as will be seen from the table the mortar itself is only worth about 20 rounds of its ammunition.

Personnel.

The table also shows the personnel allotted to T.M. batteries, this was increased about 50% in 1917 but even then it was insufficient to render the T.M.B. independent of outside assistance. The training in Heavy and Medium T.M's was usually accomplished in a fortnight, assuming the personnel has no previous knowledge of the weapons. This period, although usually sufficient for the detachments, was not nearly long enough to give the officers any confidence.

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The time allotted for training detachments for Light T.M.B's was less, sometimes under a week. In all cases much depended on the battery continuing its training under its own arrangements.

Although it was decided by G.H.Q. France in 1916 that the Heavy and Medium T.M.B's were to be manned by personnel drawn from the Divisional Artillery, infantry were frequently employed and did excellent work in these units. As a general rule infantry personnel displayed more keenness on the work than artillery personnel.

To the infantryman it meant leaving behind battalion and routine, and taking over a new piece of mechanism.

To the gunner it meant leaving behind his horse, and taking over an old piece of drain pipe.

Up to 1916 no T.M. officers were allowed on the staffs of any of the higher formations, and there was no connecting link between the Army Trench Mortar Schools and the T.M. Battery officers. In 1916 Divisional T.M. officers were appointed to supervise all the T.M's of the division. In 1917 one Army appointed T.M. officers on the Staffs of the G.O.C. R.A. of Corps and this system gave excellent results.

In addition to dealing with all matters connected with T.M's, the Corps T.M.O's were responsible for handing over the line as regard T.M's to incoming divisions, and also for obtaining material, transport, etc. from the corps.

Throughout the war the T.M. service, at best a hard one, was treated rather as a makeshift and could hold out little chance of advancement to its officers, this gave rise to invidious comparisons being drawn with other new arms which had been made into corps, whose duties did not keep them so continuously in the line, and whose establishments offered better scope for promotion.

But in spite of this Trench Mortar work possessed a great fascination for many officers, who only left their T.M. batteries with great regret, when forced to do so on promotion to a rank of which the T.M. Establishment did not admit.

PART II.

TACTICAL EMPLOYMENT OF TRENCH MORTARS.

The operations in which T.M's were extensively employed on the Western Front fall into two categories.

1. Major operations.
2. Minor operations, including the holding of a front.

The employment of T.M's in the open warfare which in 1918 succeeded the long period of trench warfare, will also be mentioned.

Major operations.

In major operations all natures of Trench Mortars are included in the scheme for the heavy bombardment prior to the assault. The tasks allotted to the various types depend of course on their characteristics.

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Heavy Trench Mortars.

Although the personnel of Heavy Trench Mortar Batteries remain with Corps, the Trench Mortars themselves were treated in France as G.H.Q. stores and were allotted to Armies by G.H.Q. as occasion demanded.

The distribution, allotment of ammunition, time tables, and general principles of employment of these Trench Mortars form a part of the Army Artillery Plan, the detailed arrangements regarding tasks, etc., being delegated to Corps and Divisions.

The Heavy Mortars are so situated as to command the various strong points, trench junctions, etc., which it is desirable to demolish. It must be borne in mind that the enormous craters these weapons produce are likely to form a serious obstacle to an infantry advance, and that in case of the assault failing, are easily fortified by the enemy. It is therefore advisable to concentrate their fire on selected points and to avoid dispersion as much as possible.

The construction of Heavy Trench Mortar positions, and deep dug-outs for storing the ammunition, is a matter involving great labour and time, and must be put in hand early. As all Trench Mortars fire at high angles of elevation the positions can be made deep and should be provided with strong overhead cover. In order to depend upon the fire of Heavy Trench Mortars throughout a prolonged bombardment, every assistance must be given them both in personnel and material, to enable them to construct suitable emplacements and bomb stores. Solid platforms of wood or cement are essential for continued and accurate fire. Every care must be taken to conceal these positions, and all work by day should be carried out under camouflage. Heavy Trench Mortars should be sited near main arteries of communication, such as trench tramways, etc., but it must be remembered that as movement in the trenches often becomes impossible some time before zero, ample provision for the storage of ammunition must be made at the Trench Mortar positions themselves.

Observation of fire, communications etc., for Heavy Trench Mortars are arranged on the same principles as for Artillery.

The rate of fire in the battle of Arras was 4 rounds per hour; this was easily maintained. (See Table IV.)

Medium Trench Mortars.

In large offensives additional Medium Trench Mortar Batteries are usually transferred from other Armies, to effect the desired concentration.

The numbers of Batteries allotted to Corps vary according to the amount of enemy wire to be demolished, and the condition and extent of his defences.

The general scheme, allotment of ammunition, time tables, etc. for Medium Trench Mortars form a part of Army Artillery Plan.

The tasks allotted always include wire-cutting and bombardment of front line trenches, the former being engaged during the early stages of the artillery preparation and the latter just before and during the intensive bombardment.

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TABLE IV.

TRENCH MORTARS STATISTICS FROM THE ARRAS BOMBARDMENT 4TH APRIL, 1917 to 9TH APRIL, 1917.

Nature of T. M.	Trench Mortars.			Front.				Ammunition.			Casualties to Trench Mortars.				
	In action.	In reserve.	Total.	Total.	Average per T. M.	Length of trenches to be bombarded.	Wire to be cut.	Carried up.	Fired.	Average per T. M. fired.	Destroyed by enemy.	Destroyed by premature.	Deficient of parts lost or buried.	Total.	Percentage of T. Ms. in action permanently lost to us.
9·45"	50	38*	88	8,800 yards.	176	56,000 yards	985,000 sq. yards.	10,000 (710 tons.)	6,222 (440 tons.)	124	2	—	6	8	4%
2"	133	103*	236		66			106,400 (2,691 tons.)	31,907 (807 tons.)	238	7	5	10	22	9

* This large reserve is due to the sudden retirement of the Germans on VIIth. Corps front rendering all VIIth. Corps Trench Mortars which had been placed in action useless.

The original calculations for Mortars for the Arras offensive were as follows :—

2" T. Ms. One to every 50 yards to fire 200 rounds per day for 2 days—wire 50 yards deep, works out to 400 rounds on 2,500 square yards wire or 1 round to 6 square yards It will be seen by the report, that nothing like this amount was expended.

9·45" T. Ms. One to every 150 yards to fire 50 rounds per day for 2 days.

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It is important to realize that it is usually impossible to count on sweeping away the whole of the wire obstacle. The bombardment of trenches must be continuous over the whole front of attack; but fire for wire-cutting should be concentrated so as to ensure passages through the wire aggregating some 40% of the whole front of attack. To attempt more than this will lead to no effective breaches being made anywhere. Wire cutting is a deliberate operation and entails accurate and well observed fire. During the wire-cutting, artillery support is very necessary as the Medium positions are usually exposed and very liable to detection.

The Medium Trench Mortars are sited to command the whole of the front line system within their range. The advantages of enfilade fire must be taken into account, and every provision made for careful distribution of fire. Considerable skill is necessary in the siting of Medium Trench Mortar positions as in big concentrations little space is available. The Mortars may often be conveniently sited in pairs with a common bomb store.

The usual types of Medium Trench Mortar positions consist of narrow emplacements with splinter proof overhead cover, or in some cases camouflage only, connecting with a deep and well protected bomb store. Good platforms are essential for bombardments.

In order to rely on the wire being well cut, and a continuous bombardment being maintained, the Batteries require ample assistance both in personnel and material.

Large carrying parties are necessary and the bomb stores should be filled some time before the bombardment.

The question of communications, observation of fire and fire control is dealt with in the same manner as in the case of artillery. In defence neither Heavy nor Medium T.M's are of much value owing to their slow rate of fire, immobility, and liability to capture.

The rate of fire in the Arras battle was 15 rounds per hour, and the allowance of bombs for wire-cutting was one bomb per six square yards of wire, assuming one bomb in six would fall in the wire.

The rate of fire was easily maintained and the allowance of ammunition more than ample, only one-third of the allowance was fired and the wire was thoroughly cut. (See Table IV).

Light Trench Mortars.

The action of Light Trench Mortar Batteries before and during an assault depends entirely upon the task assigned to the Infantry Brigade to which the Trench Mortar Battery belongs.

Light Trench Mortar Batteries are employed in two separate and distinct ways in large operations.

Firstly.—During the actual bombardment to thicken up the barrage on the enemy's front line and to prevent enemy observation or reconnaissance, especially at points where the Artillery and Heavy and Medium Trench Mortar barrage may have slackened.

These Trench Mortars do not take part in the assault.

The considerations affecting the general scheme, supply and storage of ammunition, selection and construction of Trench Mortar positions, communications, etc., are similar to those for Medium

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Trench Mortars, with the exception that the Trench Mortar positions are usually more lightly constructed, and that no telephones are allowed.

Secondly.—The Trench Mortar Batteries belonging to Infantry Brigades taking part in the assault, take no part in the preliminary bombardment, but are assembled, usually at Battalion Headquarters, ready to move forward in support of the advancing infantry.

It is impossible to lay down which particular wave of advancing infantry the Light Trench Mortars should accompany. The usual procedure being that as soon as the advancing infantry are held up by machine gun fire, strong points, etc., the support of Light Trench Mortars is called upon. The Light Trench Mortar Commander decides what support is necessary, and one or two sections are sent forward. The Mortars are rapidly brought into action in shell craters or any convenient depression in the ground, and engage the machine guns or strong point which is holding up the advance. A Trench Mortar Officer and two runners should accompany the advancing infantry as liaison, the Light Trench Mortar Commander's position being usually at Battalion Headquarters.

In making preparations for an advance, the most important points to consider are the provision of ample carrying parties, the arrangements for storage of ammunition near the "jumping off" point, and the provision of runners. The ammunition is usually carried in sandbags, each man carrying four bombs in two sandbags slung over his shoulder, the shell jackets provided cannot be worn with infantry equipment. At the lowest estimate, 40 rounds per Trench Mortar will be required as a first supply and this entails the provision of eight extra men per detachment. In round figures, an additional personnel of 80 all ranks has been found necessary for each battery (8 guns). It is essential that the carrying parties contain the correct proportion of officers and N.C.O's, and that they are properly organized, success depends largely upon this. Definite orders should be given regarding the formation of forward dumps, and maintaining touch with dumps in rear.

In defence, especially in cases of local counter-attack, this T.M. has proved itself to be a most valuable asset on account of its mobility and high rate of fire.

Minor Operations.

In minor operations all natures of Trench Mortars are sited so as to cover as much of the usually extended front as possible.

The functions of the Heavy, Medium and Light Trench Mortars are mainly to replace Heavy, Medium and Light Artillery as regards front line work.

Particular attention should be paid to the siting of the positions as the long front usually admits of an extensive choice of ground. It is often impossible to cover the whole of a Divisional Front with the Trench Mortars allowed, and it has been found best to effect local concentrations within the Division from time to time. These concentrations involve great labour, especially in bad weather, when ample assistance should be given to the personnel.

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The siting of both defensive as well as offensive positions should be considered, especially in salients and weak spots in our line. Trench Mortars should be so sited that fire can, in these cases, be brought to bear on our own front line. In enemy salients, Trench Mortars by reason of their forward positions are frequently the only form of artillery that can be brought to bear in enfilade.

Trench Mortar Commanders must be in close touch with Battalion and Company Commanders, and a good system of communication is essential.

The Divisional Officer T.M's arranges the liaison with the Artillery.

In raids, the action of Heavy and Medium Trench Mortars is the same as in major operations with the exception that continuance of fire must be arranged for after the raiding party has returned. In order to deceive the enemy, wire is usually cut in several places, but the wire must be thoroughly cut at the point where the raid is to go across. Machine guns should arrange to keep the gaps cut in the wire open at night. Light Trench Mortars have been employed with effect in covering raids, forming barrages, blocking communication trenches and covering bombers and Lewis Guns.

They have on several occasions proved invaluable when hostile mines have been blown.

Owing to their being on the spot, fire has at once been brought to bear, preventing the enemy from occupying the craters long before artillery support could have been obtained.

Open Warfare.

In the open warfare which followed our 1918 Offensive the Medium and Light T.M's played an important part.

The Medium T.M. was carried on an improvised mobile carriage made from the front wheels of the G.S. wagon on a stout steel axle.

The ammunition was carried in limbered wagons. Thus equipped the 6″ Medium Mortars accompanied the infantry, and on more than one occasion accomplished the whole bombardment unsupported by artillery.

The Light T.M's were provided with slings and carried like rifles, frequently the mountings were not used and the mortars were held in position by hand. The fact that such crude methods of firing were found effective is an indication of the low ebb the enemy's morale had reached at this period of the campaign. Handles were usually lashed to the mortars to facilitate this method of support.

The ammunition was carried in limbered wagons in the same manner as that of the Mediums.

Conclusion.

It is hoped that a short account of these curious weapons may be an assistance to the study of trench warfare. Springing into existence suddenly as they did, they now seem to have disappeared again with equal rapidity, and their future is shrouded in obscurity.

Economy in artillery equipment and ammunition will always prove a governing factor in any great warlike enterprise; and unless

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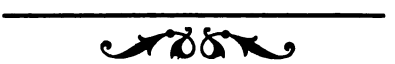
some other means of effecting this economy is discovered in the meantime, Trench Mortars bid fair to make their reappearance should such a contingency again arise.

The enemy made frequent reference to the harmful effects of our Trench Mortar fire, and there can be little doubt that the employment of Trench Artillery went far in swelling his casualty lists, breaking his morale, and hastening his final defeat.



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NOTES ON THE RETIREMENTS OF MOUNTAIN BATTERIES IN MOUNTAIN WARFARE.

By Capt. J. A. L. Deane, R.G.A.

THE eyes of the world were recently turned away for a brief space from the titanic struggle in Europe, with its dramatic finish and its multitudinous issues, to a corner of the globe which, though little more than a name to the average Englishman, has occupied the attention of statesmen for over a century. That a country as small and comparatively insignificant as Afghanistan should presume to pit its tiny power against the might of a nation like Great Britain, but fresh emerged from the field of victory, seemed so ludicrous that at first sight it was difficult to give credence to it. And this view was justified by subsequent events—but let us reflect a moment. Not so many waters have rolled under the Indus bridges since those dark days of the war when the German hordes seemed never-ending, when the lives of all were in constant jeopardy by land and sea and air, when even friendship's chains seemed to be turning to the merest gossamer. If Afghanistan had acted then as she acted at a later date it would have been no cause for derision. That she did not do so was doubtless due in part to the avowed friendship and loyalty of the late Amir, but (the writer ventures to hazard the guess) in a very much larger measure to the unceasing efforts of our Political and Diplomatic services in India. The blow eventually fell when, possibly, least expected; we countered it, and the honours remain with us. But though we forced the Afghan to a more reasonable frame of mind, let us not forget that we have in no way killed the spirit of his people nor that of the many Pathan tribes inhabiting the independent territory between the Durand line and the Administrative Border of India; fierce virile races who know no law but that of life and death, acknowledge no master but that of "force majeure." Nations may declare eternal friendship for one another and Leagues may undertake to settle every dispute by the magic talisman of arbitration but such matters touch the Pathan not one whit and he hears them only as the far-off echo of a distant thunderstorm. So it seems reasonable to suppose that war is not by any means a dead letter on the Frontier of India, whatever it may be or may become in other parts of the world—which brings the writer to the end of a somewhat unintentionally lengthy apologia for the following lines.

It may be said that Field Service Regulations and Field Artillery Training contain all a Gunner would wish to know about

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war in any form and in any part of the world. So they do, but both these inestimable little books contain their information in extremely concentrated form, more suitable, perhaps, to the soldier of some training and experience than to the novice in warfare. For the latter, amplification of a good many paragraphs seems necessary if the subject is to be presented in a rather more easily intelligible form, and if the following pages serve to clear up any of the doubts which may exist in the minds of some of the numerous officers in Mountain Artillery at present who have had but little experience of the Frontier the writer's first object will have been attained. The second is to tempt abler pens than this one to express their views on a subject which though of absorbing interest, to its acolytes at any rate, has unfortunately a wofully small mede of literature.

General Principles.

The main principles which govern the retirement of all Batteries (in the face of an enemy) are given in F.A.T. Sect. 165, and may be briefly stated as follows:—

"It is the duty of the Artillery to assist the retirement of the Infantry in every possible way, even to the extent of sacrificing itself, if necessary, for this object."

It might be as well here to point out that retirements in Mountain Warfare against an uncivilized enemy differ from those in ordinary civilized warfare to this extent, that the latter usually have to be undertaken as a consequence of superior enemy pressure, whereas the former are almost invariably voluntary and are undertaken for some specific object. For instance, a very normal procedure is for a force of all arms to occupy some enemy centre and from there to send out subsidiary columns to attack and destroy hostile villages within a reasonable radius. These columns, after completing their object, have to undertake a retirement to rejoin the main body. During their advance opposition, though sought for, is often of a very feeble nature. In the retirement however the position is reversed; this is the opportunity the Pathan waits for, and emboldened by the fact that he is now the aggressor he often attacks with the most reckless courage. He is a past-master at the harassing tactics of guerilla warfare and his knowledge of the ground, combined with his great mobility, make him a very formidable foe.

Action of the Artillery.

F.S.R. Chapter X, Section 142, para. 10, shows us clearly what the action of the Artillery should be under such circumstances, while para. 6 of the same Section lays down a definite rule, applicable to every arm, for the method of conducting the retirement.

We see from the above-mentioned paras.:—

(a) That the fullest possible use must be made of the Artillery detailed to support the retirement, i.e., the maximum number of guns possible must be in action and as few as possible on the move at any one time during the operation.

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(b) That there must be no break in the continuity of the Artillery support.

Another important point to remember is that the Artillery must so time its own movements as never to check the general retirement —by no means such an easy matter as it would at first sight appear if (a) and (b) above are to be correctly complied with, but a perusal of the following pages may possibly make this clearer.

Methods of carrying out the Retirements.

For simplicity's sake let us consider the matter from the point of view of a single unbrigaded battery of six guns. There are two recognised methods of carrying out the retirement with such a battery:—

(a) One section is sent back to a position in rear, followed, as soon as it has got into action, by the second and then by the third, the same procedure being repeated from this second battery position, and so on.

(b) Sections may be retired to successive supporting positions one in rear of the other, the rearmost (i.e., the one nearest the enemy) retiring through the successive lines covered by the fire of the other two who hold on to their ground till their own retirement can be similarly covered.

In theory the first is the better method because it ensures far fuller control of the battery by the B.C. and adheres to the principle of keeping the Battery intact as far as possible. In practice, however, it has the following limitations:—

(i) It entails greatly increased fatigue on all ranks; in a retirement of ten miles each gun would have to be brought into and out of action about eighteen times or more.

(ii) It has been found by experience that a battery using the above method cannot maintain the requisite speed except over short distances.

The second method, therefore, may be taken as that normally employed, and the writer's subsequent remarks should be understood to refer to this method only.

Time to Retire the Rearmost Guns.

From para. 2 (a) above it follows that guns should not be retired any sooner than is absolutely necessary unless it be seen that ground and visibility are very favourable and that more efficient support can be given from longer ranges than from positions nearer the enemy. No definite rule can be laid down as to the *best* time for the withdrawal of the rearmost guns because this depends on their distance from the main route and the facilities which the ground offers for retreat. Experience shows, however, that under normal circumstances, with the guns at no great distance to a flank, they can hold on to their ground till the rearguard flag* is nearly abreast of their position.

* Vide "F.S.R.," Sec. 144, para. 6.

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Speed of Retirements.

A reference to para. 3 will show that the method of conducting the operation is framed so that at no time shall there be less than four guns in action. To ensure this, however, RAPIDITY OF MOVEMENT on the part of the retiring section is essential, for, supposing sections to be retiring to uniform distances of 1,000 yards apart it is clear that the rearmost section after evacuating its position will have to cover a distance of 3,000 yards while the rearguard is traversing 1,000 only. Moreover, from F.S.R. Sect. 142 para. 6 (last five lines) we see that the retirement of the infantry has to be carried out as rapidly as possible. The guns, then, have to move at three times the pace of a rapidly retreating rearguard and the only thing which makes this possible at all is the unavoidable delay caused by the withdrawal of picquets.

Quite apart from the above, however, it should never be forgotten that a gun when limbered up is serving no useful purpose, from the point of view of the infantry, so there can be no excuse for any delay in getting guns from one position to another even if the infantry retirement is, for any reason, temporarily checked. When the ground is very favourable alternate doubling and walking over short distances is permissable, though it must be borne in mind that *unnecessary* doubling only serves to tire detachments out before they get into action, and is therefore to be avoided.

The 1st line in the retirement.

The management of the First Line in the retirement presents somewhat of a problem. The essentials are:—

(a) That it shall be got well clear before the retirement of the Firing Battery so as to avoid hampering the latter in its withdrawal.

(b) That it shall always be in a position of comparative safety.

(c) That its movements be so timed as to render it accessible to the Firing Battery for the replenishment of ammunition, replacement of casualties, etc.

(d) Its action must be automatic and not dependent on the receipt of constant fresh orders.

At present there are no rules laid down in any official publication for the conduct of the First Line movements in a retirement and each B.C. has his own views on the subject. The method outlined in the next paragraph was first suggested to the writer by a Mountain Artillery Officer of long experience. It appears to give such satisfactory results in practice and is so obviously based on sound logic that it might be well worth any Battery's while to give it, at any rate, a trial.

Details of a retirement.

The following is a brief sketch of the details of a normal retirement:—

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(a) Suppose the battery has been detailed as part of a rearguard, and is in action covering a position from which a retirement has to commence (it is immaterial whether the sections are together or each in an independent position).

(b) The B.C. receives full information as to the intentions of the O.C. Force, the positions of picquets, the dispositions of our own troops, the hour at which the retirement is to commence (zero hour), anything that is known of the enemy and any special instructions which the O.C. Force may wish to give him.

Having been told what is required of him he should as a rule be given a free hand in carrying out his orders.

(c) He in his turn communicates as much of the above information as he considers necessary to the battery captain and section commanders, and gets in touch with the rearguard commander.

(d) Well before the time at which the retirement is to commence he sends the captain back, with the necessary party, to chose positions in rear for the sections.

To facilitate the subsequent explanations we will call the sections "A", "B" and "C" respectively.

(e) About 40 minutes (or more, if he considers it necessary) before zero hour he sends "A" section and all the First line (less any ammunition and bareback mules he may consider it necessary to keep with the Firing Battery) back to the first position chosen by the captain.

(f) When this section gets into action he sends back "B" section to the second position chosen. The section commander of "B" picks up his own and "A" section's first line on the way (unless "A" section's first line has already been taken back by the captain) and, on arrival at the position where he is to come into action sends his own first line to a place near the road and approximately abreast of the third position, keeping "A" section's first line near the road and approximately abreast of himself.

(g) The general retirement, we will say, then commences. The section commander of "C" when he receives the order (or if given a free hand when he considers it necessary) retires to the third position picking up his own first line on the way. He replenishes ammunition, etc. and on arrival at the position sends his first line on to a place abreast of the fourth position. This procedure is then repeated by every section in turn.

The first position for "A" section must be so chosen that it is possible for this section to support the infantry from the very beginning of their retirement. "B" section's position should be chosen with a similar object in view unless the ground does not admit of it, in which case this section should only be retired in time to allow of it getting into action again just before it becomes necessary to retire "C". This may be some considerable time after the general

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retirement has commenced, though no definite rule can be given and the B.C. must be guided by circumstances. If, however, conditions are favourable it is generally advisable to start the *Battery* retirement in time to allow of both the first and second sections being in action before the *General* retirement commences. The period 40 minutes (vide "e" above) is only given as a rough guide for normal cases. Under exceptional circumstances it may be necessary to keep all six guns in their original positions till after the commencement of the general retirement, but in any case the withdrawal of the sections should be so timed that at no period of the fight are the infantry supported by less than four guns. Herein lies the secret of all successful retirements, i.e. correct timing.

The reasons why each first line is sent to a position near that of the next section in rear are:—

(i) Though well clear and in a position of comparative safety the first line is yet not so far away as to render it impossible for mules to be sent up to the firing battery in time, if urgently required.

(ii) In case of shortage of signallers a section can communicate with its first line through the medium of the section next in rear.

(iii) The section first line commander, who is usually a driver Havildar or Naik, will have a British Officer near him whom he can consult in case of doubt on any point.

(iv) Each section except that in front will have a section first line near it from which it can draw immediate replacements in case of great need. Section commanders before doing this, however, must be careful to get the permission of the other section, for, being nearer the enemy it may be in as bad, if not a worse plight, than he himself.

Duties of the B.C.

The B.C. should bear in mind the following points:—

(a) He should remember that, just as it is important for him to have a free hand himself, so is it essential for the sphere of action of his section commanders to be not unnecessarily limited. Tell a section commander what he has to do and let him do it in his own way. Undue or untimely interference is the most fruitful of all causes of misunderstandings and of work inefficiently performed. The above, of course, presupposes that the section commander knows his work and is capable of carrying it out correctly. It is the duty of the B.C. to see to the former, and if the latter be not the case there is no alternative but to get rid of that particular officer as soon as possible for "the Pathan is the best umpire in the world"; he never misses a mistake on the part of his adversary nor fails to take advantage of it, so there is no room for inefficiency on the Frontier.

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(b) The B.C. should keep his section commanders posted with the latest information, and should see that the sections are at all times distributed to the best advantage.

(c) It is the duty of the B.C. to keep in constant touch with the Rearguard Commander, to learn from him all he can about the enemy and the dispositions of our own troops, and to give effect to any of his requests for assistance from the guns. At the same time he should be careful never to hamper the Rearguard Commander in his work by unnecessarily thrusting himself forward when the latter's attention is probably fully occupied elsewhere.

Duties of the Captain.

The duties of the battery captain are as follows:—

(a) He choses the lines of retirement for the sections, bearing in mind the instructions he receives from the B.C., has range cards made out so that sections can open fire after coming into action, with the least possible delay, and generally assists section commanders.

(b) In judging of the distances which positions should be from one another he is guided by the following considerations:—

(i) If positions are too near each other considerable waste of time will occur through the guns being continually moved, and fatigue to detachments will be greatly increased. Normally positions should never be less than 600 yards from one another.

(ii) If the country is fairly easy and visibility good there can be no object in over shortening each retirement for mountain guns are able to give efficient support at ranges up to fully 3,500 yards.

(iii) On the other hand if sections have to cover a very considerable distance they must necessarily commence their retirement long before that of the Infantry which, as has been shown above, is undesirable. Also difficulties of communication and control by the B.C. are greatly increased. From the generally accepted views of Mountain Artillery commanders we may say that positions should not as a rule be more than 1,500 yards from one another.

(iv) Summing up the matter we see that 1000 yards is a good all-round distance in the case of a 6-gun battery under normal conditions.

(v) Under special circumstances it may, of course, be necessary to depart absolutely from the above as for instance in the passage of a narrow "Kotal"* where it is quite impossible for the sections who have crossed to see any targets from the other side. As the passage generally takes some considerable time troops are rather inclined to "bunch", and in such a case it might be necessary to concentrate two, or even all the sections, on or near the "Kotal" itself.

* Kotal = a pass over the hills.

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(c) Covered positions are rarely necessary or advisable in this form of warfare for the Pathan has no Artillery and targets are almost always in the nature of "fleeting opportunities." Positions chosen should be easy to retire from, and should not therefore be far from some road or track by which the section can get quickly back to its next retirement line. For the same reason they should not be chosen on high or difficult hills unless it is impossible to obtain the requisite command in any other way.

One word of caution is necessary—don't waste time in searching for ideal positions; they are very few and far between. On the Frontier you are very apt to be lured from place to place by what, from a little distance, appear to be better positions than the one you are on; after closer inspection, however, they are nearly always found to have as many defects as the original one, so be prepared to make up your mind quickly. Remember that in a retirement every second counts.

Duties of Section Commanders.

(a) From the moment the retirement commences each section commander is responsible for his own First line.

(b) They should supplement the information they receive from the B.C. by enquiries as to the position of picquets, etc. from road sentries and others, on the way back. This is specially important when retiring over ground which the force has not already traversed that day and which has consequently not been previously picqueted. In this case fresh picquets are being constantly put out by the Advanced Guard Commander and their positions, being unknown to the B.C., will not have been previously communicated to section commanders.

(c) When in action they should post look-out men to watch definite areas of ground, and they should be careful to see that their signallers are in constant communication with the B.C. and with other sections.

(d) If no escort has been provided and they consider one necessary they should apply for it to the commander of the nearest troops (F.A.T. Section 148).

(e) They must be ready at all times to act on their own initiative if circumstances demand it.

(f) They should not as a rule retire till they are sure that the other two sections are in action behind them, unless they see that this would necessitate them holding on to their ground so long that the general retirement might have to be held up on account of it.

(g) In the absence of the battery captain they may have to chose their own positions, in which case they should be guided by the principles already detailed.

As regards the occupation of positions: Some authorities hold that guns should almost invariably be brought into action behind the crest and run up by hand so as to obtain the full effect of surprise and to be able to unlimber under cover. A reference to para. 9 (b) above will show, however, that in a retirement the section coming

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into action is normally *at least* 1,200 yards from the firing line (in the case of a 6-gun battery) and at this distance guns have but little to fear from rifle fire. For the same reason the "surprise" factor is practically non-existant. The time wasted in coming into action plus the extra fatigue to detachments is not by any means compensated for by the supposed advantages accruing from special methods of occupation. A few well aimed shots put in as quickly as possible after the section arrives at its position has far more moral effect than the sudden appearance of a pair of guns somewhere on the horizon.

When withdrawing guns out of action the position is reversed. Here the guns which retire are those nearest the enemy, hence they will presumably be under a heavy rifle fire. Also, the enemy should be kept in doubt up to the last moment as to exactly when the guns are going to retire. Hence, guns should normally be run back by hand and limbered up under cover.

(h) The section commander should remember to give the preliminary orders for the retirement well beforehand so that at the last moment no unnecessary stores, such as pioneer racks etc. may be left on the ground, the loading of which might delay the retirement of the section.

(j) During the time the section is actually on the move it should always have at least one ground scout ahead so as to avoid delay in case unexpected obstacles are encountered.

(k) Finally, section commanders must bear in mind that although the retirement of each section is covered, if possible, by the fire of the other two, the infantry have the first call on the services of the guns and the task of supporting the latter must not be subordinated to that of assisting other sections.

Specialists.

(a) The B.C. should have with him the Battery Sergeant Major (Havildar Major in an Indian Mountain Battery), three signallers, one of whom should, if possible, be mounted, a horseholder (usually the senior trumpeter) and if none of the signallers are mounted, a runner.

With regard to this last man: From conversations with various Mountain Artillery officers it appears that few of them, even after the experience of this war, fully realize the value of runners. A concrete example will perhaps make this point clearer:—

Suppose a message of 30 words has to be sent over a distance of 600 yards in normal Frontier country. Trained signallers, provided they are already in communication with the station to which the message has to be sent, and working under conditions such as would exist during a retirement, take about six minutes to get the message through. A trained runner can easily deliver the message in four minutes (i.e. just two thirds the time) while a mounted orderly takes only about 2½ minutes. In addition to this there is the certainty that the message will be delivered as the B.C. wrote it, and not in an almost undecipherable form as it often is from signallers working under difficult conditions.

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(b) The captain should have with him two signallers, two range-takers (or one mounted rangetaker if a one-man range finder is available) and a horseholder—usually the second trumpeter.

(c) Each section should have three signallers with the Firing battery and one with their first line; also a pair of rangetakers. One section will have no range-takers as these will have been sent with the captain. This section will have to do the best it can with the range card which it gets from the captain and which should consequently be more fully and carefully made out than those for the other section.

(d) If the battery is short of signallers communication can still be fairly efficiently maintained by distributing available signallers as follows:—

B.C. 2, Captain 1, and the firing battery of each section 2, total 9. In this case the B.C. should have 2 runners and each section will have to keep up communication with its first line by the same means, or as indicated in para. 7.

Retirements with 4-gun batteries.

A retirement of a battery of 4 guns is carried out in an identically similar manner to the above except that in this case each section has more time, positions can be chosen rather further apart (1200 yards is a good all-round distance) and guns can remain in action for slightly longer periods.

Some misconception appears to exist as to the difficulty of retirements with 4-gun batteries. The actual retirement itself presents no such difficulty and the details are, as already stated, practicaly identical with those given above. The only real objection lies in the paucity of artillery support which it is possible to ensure at all times. To express the matter in terms of percentages—with 2 sections it is only possible to guarantee that there shall never be less than 50% of the guns in action at any one time whereas with 3 sections it is nearly always possible to ensure 70%. When therefore it is remembered that the guns often have to cover a zone of 180 degrees or more it is easy to understand why retirements with 4-gun batteries find no favour with B.C's.

Co-operation with the Infantry.

Efficient co-operation between Artillery and Infantry depends to a large extent on good communications. In mountain warfare retirement the speed of the operation is so great as to preclude altogether the use of any other than visual signalling or orderlies as a means of communication. For the same reason, and owing to the fact that every officer in the Battery is already fully occupied elsewhere the employment of F.O.O's with the infantry finds no place in this form of warfare. Hitherto the only connecting link between the artillery and infantry has been, as a rule, the B.C. whose normal function, as already explained, is one of liaison between the two arms.

The very nature of the operation makes it necessary, as a rule, for the infantry to cover a wide front and there are many isolated units such as picquets.

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Requests for artillery support from various units in a Battalion can therefore only reach the Battery after considerable delay if sent through the ordinary channels viz: Battalion commander, Rearguard commander, B.C. to Battery.

Hence it is obvious that when speed is the object such requests should be transmitted by the shortest possible channel consistent with correct distribution of fire to those places where it is most urgently required. Experience shows that very satisfactory results can be obtained by Battalion commanders communicating direct with the guns, though in the case of isolated bodies it should be left to the discretion of smaller unit commanders to call direct on sections for artillery support provided the circumstances are sufficiently urgent to warrant such a procedure. This, of course does not absolve the officer in actual command of the battery or section at the time from taking all such steps as are within his power of closely watching the situation at all times and himself directing fire where he considers it most necessary without any request from the infantry.

Whether the above be accepted as a principle or not we are still faced with one great difficulty viz: that of the description of targets from forward positions. This question has, however, been fully discussed by the writer elsewhere and space forbids its inclusion here.

The Mountain Howitzer.

It will be observed that in the above pages no reference has been made to the Mountain Howitzer, a new weapon whose potentialities have been proved by very recent experience. As full details are not yet forthcoming the writer has thought it best to confine himself to the tactics of batteries armed with the mountain gun. It is to be hoped that some officer with a practical experience of the howitzer may enlighten us on the subject.

Conclusion.

It has been impossible in this short sketch to touch on many important points, such, for instance, as the part the artillery plays in the withdrawal of picquets but it is hoped that enough has been said to give a fairly clear picture of what is perhaps the most difficult operation which a battery has to carry out on the Frontier.

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PRÉCIS OF THE REVUE MILITAIRE SUISSE.

February, 1920.

By Brig.-Genl. H. A. Bethell, c.m.g., R.A.

The Strategical Value of the Swiss Territory.

Colonel Feyler continues his examination of the question whether it is worth the while of a belligerent nation to violate Swiss territory. In 1916, would the Germans have done better if they had advanced through Switzerland on Belfort instead of attacking Verdun? The author considers that they were obliged to attack Verdun as a defensive measure to prevent the French from breaking through. If they had attacked through Switzerland the Swiss army would have retired before them till supported by the French, and would not have retired to their mountains to take up a flanking position, as the Belgians unwisely did at Antwerp. Similarly, would the Anglo-French force of 60 divisions, which was concentrated for the battle of the Somme, have been better employed in an attack on the German communications through Switzerland? Possibly, but only at the expense of the high moral spirit of liberation in which the Western Powers entered the war.

In 1917, when the Russians dropped out, the Central Powers decided to reduce the odds against them by smashing Italy. But they considered that the Swiss passes would be of no use to them in this operation. However the Western Powers were uneasy about this, and in 1917 a Military Convention was agreed on between France and Switzerland, arranging for the co-operation of their armies if the Germans attempted to violate Swiss territory.

As regards the next war, the best security for Switzerland lies in the fact that the Western Powers would have more to gain than the Central Powers by violating Swiss territory, and therefore the Germans will be careful to respect Swiss neutrality.

The Organization of the Swiss Army.

The January *Revue* stated that the army was to consist of 8 divisions, two being mountain divisions. The author argues at length in favour of four mountain and four lowland divisions.

Correction of Artillery Fire by Lateral Observation.

The author is in favour of correcting fire on the line of observation, a method well known at Shoeburyness.

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PRÉCIS OF MEMORIAL DE ARTILLERIA.

January, 1920.

By Brig.-Genl. H. A. Bethell, c.m.g., R.A.

Searchlight projectors in Coast Defence.

(From the Journal of the U.S. Artillery.)

The article advocates high sites well on the flanks of the armament, and crossed beams. Good communications and organization are required to ensure that all the beams do not settle on one target, leaving the rest of the attacking ships in darkness.

Lead and zinc alloys for shrapnel bullets.

A light bullet of large diameter was specified for the Spanish 6-in. and 4·7-in. guns. Tin was too expensive. It had been hitherto supposed that lead and zinc would not alloy, but it was found that by adding 14 per cent of antimony and 0·1 per cent of aluminium a good and cheap zinc-lead alloy could be produced.

Military Notes.

Since the German armament has been reduced to a minimum by the Entente, it is necessary that it should be the best possible. It is proposed to introduce new-pattern machine guns, especially one pattern capable of perforating tanks.—The nominal peace strength of the French army before the war was 750,000: it is proposed to reduce it to half that number. The cavalry will be considerably cut down, and the "Army" artillery brigades will be increased.—"La France Militaire" considers that poison gas will be extensively employed during the next war. It will be of two kinds, the first of an evanescent character so that attacking troops can advance after a gas bombardment; the second kind will be such as to permanently poison and neutralize a tract of country. The gas should be "insidious", so that men do not know they are being gassed till too late.

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PRÉCIS OF THE RIVISTA DI ARTIGLIERIA E GENIO.

BY MAJOR G. E. A. GRANET, D.S.O., M.C., R.F.A.

The Strategic Rôle of Fortresses in the late war.

After a brief account of the fortified systems of France, Belgium, Russia and Germany, the author traces the operations on the Western Front in 1914 and on the Russian Front in 1914/15. He give a very clear affirmative answer to the question "Was the time and money spent on these works worth while." A very interesting article, which, with a little pruning would be worth translating "in extenso."

Artillery Fire in support of Infantry Attack.

The Creeping Barrage was devised to deal with the Defence in Depth and the Defensive Zone.

From the experiences of the Austrian attack in June 1918, it seems that the barrage has become too inelastic. The Austrian attempts to control the barrage by means of coloured lights was a failure. The author quite recognises the difficulties that exist in the way of ensuring adequate co-operation between the infantry, the O.P's and the Batteries, the development of wireless from aeroplanes will do a great deal to help, but probably the real solution will be found in Tanks, their functions are at present analogous to those of the creeping barrage. At present their use is too much limited by the ground, especially in the mountainous regions of the Italian Frontier. Tanks will also be required to carry out changes of position of light and heavy field artillery on ground where other forms of transport are not possible.

By these means the assaulting infantry will be assured of a real moral and material support.

The 17" Howitzer.

This is practically a small handbook of the Austrian 17" How. with descriptions, diagrams, photographs and range tables. There are also various photographs of the gun in transit by rail and on its mounting in the Piazza Venezia in Rome.

Aviation in the late war.

There is nothing of interest in this article.

Methods of eliminating the flash of artillery.

Translated from two papers read at the Academy of Science, Paris. The flash is caused by the instantaneous combustion of Carbon Dioxide from the charge on meeting the air.

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There are two methods of eliminating this flash, both depending on cooling the gas below combustion point. They are:—

A. Physical. By combining with the charge salts containing water of crystallization, which decompose in the bore and absorb heat; or, more simply, liquid water. (To damp the flash of a 75$^{m}/_{m}$ gun 150 cc of water is needed.

B. Chemical. The damping properties of the following substances were particularly investigated; wood carbon powdered to the state of black smoke, graphite, heavy oil, naphthaline, mononitronaphthaline, sulphur, &c.

These must be prepared and used in such a way as to come, molecule by molecule, into instant contact with the gas of the charge.

It is preferable to have the substance in a pasty or liquid state rather than dry, because the grains, however fine, can only react on their outer surface.

The reactions of Carbon and Sulphur are shown in the following thermo-chemical equations.

$$C02 \quad C \quad 2CO - 68 \text{ calories.}$$
$$2C02 \quad S \quad 2CO \quad S02 - 119 \text{ calories.}$$

By a suitable increase in the weight of the charge according to the gun for which it is intended, the flash of the following guns has been totally eliminated without any change in the normal pressure or velocity:—75, 105, 120L, and 155L.

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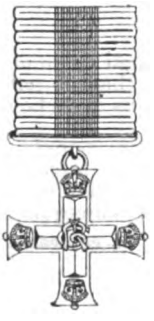

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THE PASSING OF AN ARMY FROM WAR TO PEACE.

A Lecture delivered at the Royal Artillery Institution, Thursday, 25th March, 1920.

By Major Genl. Sir C. H. Harington, K.C.B., D.S.O.
(Deputy Chief of the Imperial General Staff).

Major General G. McK. Franks, C.B., in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, I have very great pleasure in introducing to you this afternoon our Lecturer of to-day, General Sir Charles Harington, Deputy Chief of the Imperial General Staff, who is going to lecture to us on "The Passing of an Army from War to Peace."

General Harington, as you all know, has had very exceptional experience both during the war and after it. During the war he was with the Third Corps, then with the Canadians, for a long time the right hand of Lord Plumer, and since that time he has been in the very important position of Deputy Chief of the Imperial General Staff. I think we could not possibly have a Lecturer better qualified to give us the information we seek upon this subject which is very important to all of us, and I am sure we shall listen with very great interest and satisfaction to what the General has got to say to us. (Applause).

Genl. Harington: Genl. Franks, Ladies and Gentlemen: Needless to say I feel greatly honoured at being asked to lecture at this great Institution.

I am well aware of the class of lecturer to whom you are used and I confess I thought a long time before daring to accept your kind invitation.

I did so for the same reason that I have accepted similar invitations in many of our Commands: viz., to get an opportunity of going out to tell people the truth about the Army.

I am and always have been of opinion that we never tell our Army enough. I know it is difficult, but I started this method when M.G. G.S. of the Second Army under Field Marshal Lord Plumer in France, by getting all the Commanding Officers and Artillery Brigade and Battalion Commanders together in turn and telling them all I knew. I have tried to follow the same course since.

There is a reason for everything that is done and generally a good reason if the facts are only known. Unless they are, the decisions often appear vicious. Much of the uncertainty and many

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of the rumours that have been travelling the Army are entirely attributable to ignorance of the facts.

What I am going to tell you has at least the merit of being the truth.

Believe me when I say that I have not come here to make any excuses for the War Office, or claim credit. Nothing is further from my thoughts.

I want to give you a picture of what the Army has been through during the past two years in order that you may at any rate appreciate what the task of passing an Army from War to Peace means.

No one, unless he has lived in the middle of this gigantic problem, can have any idea of what it means.

Certainly I had none. My horizon was bounded by the Company I commanded and trained up to August 1914, and I often wish I had that Company still.

It will be convenient if I ask you to throw your minds back just a couple of years and picture the situation just after we had received that serious blow in the southern portion of our line on the Western front. These were sad days and very serious ones. The Army was hard hit not only in precious men but in material and back arrangements. From all sides help was being sent to fill the gaps. We, in the North, were sending down all our 14 Divisions. Our gallant French Allies were sending help from the South.

A momentous Conference was held at Doullens between the Allied Commanders who decided, come what might to stick together. That was when Marshal Foch assumed control and we all admire the splendid loyalty of Lord Haig and other Allied Commanders to his direction and no one appreciates it more than Marshal Foch himself.

It was a close thing, but the danger was not over. Our line was very thin. On April 9th the storm broke again on the left of the First Army front and next day broke on our Second Army.

We then went through a bad time. We had sent all our 14 Divisions less one to the South and we had nothing but tired and weak skeletons in their places which had all suffered heavily, and I for one shall never forget what those men and what those gunners did during the next three weeks. Three times was our Second Army line in two or three pieces. I can see those gaps now.

So thin were we that every servant, every student, every instructor at our Schools was in the firing line at Strazeele and Hazebrouck endeavouring to hold on until an Australian Division arrived from the South, and what a narrow shave! The Amiens line had gone. The only way to reinforce was by Etaples and the Boche missed the Etaples Bridge almost by inches with bombs. We had no reserves of any kind. How we welcomed the French Army which Marshal Foch sent us later. Those were momentous days and sad ones for us to lose our beloved Messines Ridge and Kemmel and to have to withdraw from Passchendale salient, but the line held and the danger to the Channel Ports lessened.

In May 1918 I was ordered home to my present appointment and discovered that I was responsible that the requirements of all theatres of war were met.

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As regards men this was a hopeless task. Every available man had been sent out. Every "beat up" produced but little and the A.G's forecast showed that until August 15th we should get steadily worse. Ireland had not conscription.

The situation therefore was that we could give our Armies in France but little and other theatres "nil".

The maximum that shipping could do showed that we could at most get 120,000 Americans over per month. Thanks to the supreme effort of the British Navy and the Ministry of Shipping this number was subsequently increased to over 300,000.

I remember about this time attending a lecture given by the C.I.G.S. to the full War Cabinet at which the Colonial Premiers were present.

It was a lecture on the strategical situation in all theatres and a masterly appreciation of the world situation and a warning of what might happen and what was required to avert it.

I remember as our line became more stable and things began to look as if there would not be another big operation before the winter, a wire being sent to Lord Allenby asking him what he could do against the Turk if we sent him six Divisions from France for the winter.

I remember his reply—viz. that he could get as far as the line Acre—Sea of Gallilee, but that he could not stay there if they were taken away.

He submitted his plans and I recollect being told to send him a wire that he could have none.

He got none but you know his subsequent achievements.

I remember at this time holding several conferences on Tanks and ordering 6,000 Tanks and 10,000 Tractors with the approval of Marshal Foch in order to carry out a big offensive on a 100 mile front in July 1919 as a decisive effort to finish the war! There were some who thought we ought to wait till 1920.

I recollect a certain Sunday morning when the British line was thin, and a wire came in to say that Marshal Foch had ordered several British Divisions South behind the French. What excitement there was. The Cabinet ordered a Minister and D.M.O. to go at once to see Sir Douglas.

He was quite unmoved and wished to raise no protest. Extraordinary. Before they got back the attack on the French E. and W. of Rheims had started. Marshal Foch knew it was coming; so did Sir Douglas but they wisely did not tell others!

I will not dwell on the later phases. We all know of the glorious French attacks and of our own record from August 8th onwards. The planning and execution of the subsequent operations will best be read in History. It will be quite impossible for me to review these or to say what we owe to Regimental Officers, N.C.O's and men, and for me as an Infantry Soldier, to say what we owe to our comrades in the Royal Artillery.

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But do not let us forget the other threatres.
The wonderful operations of Lord Allenby.
The Salonika operations of the Allies.
The Allied operations in Italy.
The Archangel operations.
The operations in Siberia.
The operations in Mesopotamia.
Mission work in S. Russia. (Still going on).

All the troops that took part in those operations deserve far more credit than they have been given.

I know their difficulties.

They had to go short of everything. It was cruel work refusing.

Many in bad climates—little or no leave and yet think what they did.

Those wonderful days are like a dream.

It seems as if the Allies got up together in every theatre as one big wave and carried everything before it.

It was indeed a crash. One Power after another fell.

One little thought then—on 11th November 1918—that the world would be in its present state 18 months afterwards.

The fact remains that since 11th November 1918, we have had plenty of troubles:—

(a) In Egypt.
(b) In Afghanistan and India.
(c) Strikes at home.
(d) Uncertainty whether Boche would sign.
(e) Troubles in N. Russia.
(f) Collapse of Koltchak.
(g) Success and collapse of Denikin.
(h) Troubles in Persia.
(k) Now troubles over Constantinople and Turkish terms.

and many other difficulties including Bolshevism and Ireland.

Throughout all this we have had to get rid of our huge conscript Army and build a new one. It has been a task of no mean magnitude.

Whatever the mistakes made, and there have been many, the fact remains that the Government has taken on many more commitments than we had before and that in spite of all these troubles, the great Empire is held at this moment by a newly raised Army and in a few days the whole of our conscript army will have gone and most of the stores, etc.

A year ago such a result would have been deemed impossible. Mind you, the task has not been made easier by the Public and part of the Press. When the Country was in danger the public opinion was helpful. From the moment danger was past, it has been otherwise.

The whole scheme of demobilization was, as you remember, nearly wrecked by pressure.

It was only human nature. The public wanted everyone brought home on the same boat.

The same people who wanted no operations till 1920, until we could get the full force of all the Allies, were those who knew all along that the War would be over in 1918.

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They were the same people who screamed loudest at Slough and Poole Harbour expenditure and scoured the country for scandals.

In the last months of the war every theatre was screaming for mechanical transport.

Thousands of vehicles were wanting repair. Ministry of Munitions could do nothing.

There was only one solution. Do the job ourselves, and had the war gone on it was the only method that would have kept our Armies in the Field.

Few if any of you know, that even had we lost the Channel Ports we could and would have kept going. No one was more determined on this matter than the Prime Minister. We should never have failed our Allies.

We had to make preparations. It is no secret now to say that we brought a good deal of surplus out of France including the bridges for crossing the Rhine which we had had for years. We reduced our reserves and kept them ready at our ports here. We improved Poole Harbour to make it a Base.

You cannot make war on that scale without big and rapid preparations and money must be spent.

These are only samples. There are thousands of other examples.

If, however, the war ends, as it happily did, and you save thousands of lives you are blamed for reckless extravagance.

If you don't make preparations you lose thousands of lives and are blamed for inaction. What matters is the care of men's lives.

Everyone is very wise afterwards.

Now I will review shortly the period since the Armistice.

A.G's Branch.

Whether the Demobilization scheme by trades and categories was sound or not is not for me to say. It was the decision of the Government to do it that way.

It nearly came a cropper at the start and the machinery quite naturally took a little time to get going, but the fact remains that the machinery has dealt with up to 17th March :—

180,717 Officers.
3,818,157 Men.

The whole of the Dominion troops, Americans, natives, etc. have all gone months ago, and in a week or two the shutters will be up. It is a truly remarkable performance especially when one thinks of the stories we used to hear of it going to take years and years to get the army home. The rate of dispersal reached 40,000 a day. Almost as many men as attend a Cup Tie Final. In March 1919 the Mobilization Directorate was handling 850,000 letters a week.

The dispersal machinery which at one time was :—

1,121 Officers.
24,327 Men.

has now been reduced to 55 officers, 1,395 men, and Mobilization Directorate, War Office, which was 190 Officers, 1,270 clerks to 60 officers, 310 clerks.

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With Demobilization must be considered mobilization, and every arrangement for mobilizing 20 Divisions—6 Regular and 14 T.F. has been worked out, and stores and equipment such as we never had before has been sorted and stored for the purpose.

During this time a special branch was established under the A.G. composed of 3 Fighting Brigadiers to investigate all the cases of surrender and it is satisfactory to note the fact that the vast majority of surrenders were due to the most indomitable courage, and to the fact that officers and men fought to the last and would not retire.

It is satisfactory to note that since 1st September last 350,000 enemy prisoners have been sent back. We still have some 55,000 Turks awaiting shipment.

The figures of the R.A.M.C. are interesting.

The pre-war establishment of R.A.M.C. was:—

1,068 officers and 3,895 other ranks.

At Armistice:—

14,461 officers.
1,524 civil practioners.
131,361 other ranks.
18,660 V.A.D's etc. and G.S. women.

8th February:—

3,338 officers.
322 civil practitioners.
18,412 other ranks.
4,771 V.A.D's, etc.

Vaccine Department.

Extraordinary figures.

33 million doses against Typhoid, Cholera, Dysentry, during last five years.

Figures are not in from all theatres.

In Armies in France from start of war to end of 1918, only 7,423 cases typhoid and para typhoid with 266 deaths.

As a contrast, Boer War cost us—

57,684 cases and 8,022 deaths.

In French Army before it was fully protected by inoculation, i.e. start to October 1915—

95,809 cases and 11,690 deaths.

Later more like our own.

Germans give 7,751 deaths.

They had both more deaths than we had cases.

Hospitals in United Kingdom.

Numbers in Hospitals—

At Armistice	316,000
1st February	28,000

Nurses demobilized to 1st February—10,830.

V.A.D's, etc.—8,915.

Great progress with Graves Registration.

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Quarter Master General's Department.

The Q.M.G's services form an interesting study.

I doubt if anyone realizes the enormous burden which fell upon the Administrative services during the war or since.

In 1918 early part contracted—then expanded.

Time of Armistice it was working at full pressure.

To feed and clothe 5,000,000 men and 1,000,000 animals is no mean task, but our Army had its Schools of cookery, laundries, disinfectants, etc.

Transportation.

In France alone at Armistice—

1,800 miles of standard guage in situ.
1,700 miles of 60 centimetre.

6 railway workshops and 4 store depôts value 7 millions.

Docks, Inland W.T. Channel ferries for heavy guns and ammunition. Similar arrangements in Mesopotamia and Egypt.

Since Armistice to 31st January, 1920, the following have been moved:—

	3,912,500 tons (a) 2,145,000 men	U.K. to abroad.
(b)	659,000 men 25,000 horses.	Carried between stations abroad.
(c)	4,158,000 men 94,000 horses. 2,786,900 tons	From abroad to U.K.

Total—

6,962,000 men 119,000 animals 6,699, 400 tons	Moved Armistice to 31st Jan. 1920.

Stores value £100,000,000 brought to United Kingdom.

Remounts.

Armistice—

804,000 horses and mules in all theatres (7·42 sick). Now only 140,000 of which 15,000 boarded out.

Up to 31st Dec. 1919—544,000 sold = 19 millions.
128,000 of them sold in U.K.

Indian Army brought up to strength with efficient and sound animals.

Matter of congratulation no epidemic into U.K. or other countries.

Ordnance.

At Armistice—280,000 tons ammunition at Base Depôts.
240,000 tons ammunition in forward areas.
200,000 captured German.

Value at cost price of all stores = £1,000,000,000!

All stores were scattered and had to be examined. Our mobiliza-

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tion Reserves had to be set aside and brought home. Remainder had to be listed for Disposals Board.

Quartering.

Before war in U.K. had accommodation for 160,000.
During war erected for 1 million.
Over 70% cleared and thrown up.
At Armistice W.O. had hired 18,216 buildings, and relinquished 17,070 buildings.

Supplies.

R.A.S.C. before war...	456	officers.
	5,790	other ranks.
11th Nov.	11,564	officers.
	314,824	other ranks.
Present	3,587	officers.
	36,764	other ranks.
At Armistice we had ...	83,373	4 wheeled (M.T.)
	33,900	2 ,,
Now	16,421	4 ,,
	6,562	2 ,,
At Armistice we had ...	11,000	tons food (handled daily).
	8,000	forage
Now	1,400	tons food.
	1,400	forage.

These are wonderful figures and show wonderful work. Not being connected with any of it I mention it.

Generally recognized how well equipped and fed our Armies were.

Had it not been for whole hearted manner in which skilled civilian personnel threw themselves into military work, these great administrative achievements would have been impossible.

Now I turn to the New Army.

Its life so far has been full of difficulties.

The process of building an army at all during the process of disbanding another one would of itself have been a big enough task for anyone had the world been at peace—whatever we may call the last 16 months, it can hardly be called "peaceful."

When given the task we may be pardoned for assuming that the Governments concerned would have finished their tasks long ere this, or would keep their armies until such time that they saw their terms being enforced.

A year ago the Allies had 10 million soldiers to talk with. What a shadow exists now and how much is settled? However, it is none of my business to criticize Governments.

They have their troubles, and our duty is quite clear, viz. to do our best with whatever material we have, to carry out their policy.

I have no doubt they sometimes wish they had a few more

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soldiers. It is the power to enforce which has grown weaker and weaker.

The trouble is that they think they have quite a lot still because it is impossible to convince people who have not been soldiers what an effective strength is.

If they see there are say 20,000 in Egypt and Mesopotamia or Ireland, they will think that means 20,000 fighting men all armed to the teeth.

Of course it means nothing of the sort. 79 battalions abroad, 51 in England, 28 in Ireland, average strength 500—effective 300, mostly very young and untrained is approximately what we have.

The total numbers in theatres includes all the administrative services—natives and others making roads and railways and a thousand and one other things.

No one who is not a soldier can appreciate these things.

But I am the last person to say, or want to say, anything against the Government. Personally I never say a word against anyone whom I have known behave well when we were in trouble or in a tight place, and I recollect several occasions in those fateful months between May and August 1918, when we were in sore straits when many a good, firm and plucky decision was given to our proposals. I don't forget those things.

I also go so far as to say, that if it had not been for the splendid energy and drive of the present S. of S. we should never have carried out the task that has been accomplished.

He took over S. of S. in January 1919 I think, when we were in a real muddle over demobilization. He at once took his coat off, and I can safely say has never put it on since.

The path we have had to tread has been a very rough one, full of obstacles, full of uncertainty and destructive criticism.

In spite of this it is fair to claim that birth has been given to an Army which, if properly nourished, will in years to come rival that wonderful body of "old contemptibles" to whom we owe so much and to which History will give due honour, as do our gallant Allies.

Many critics say "you want this—you want that". The war has proved this and that. When listening to all these schemes I always say to myself "What was wrong with the old Army?"

In broad outline, the real problem is—

(a) To get the best lessons from the recent war.
(b) To organize an Army capable of defeating those lessons in years to come if need be.

Probably ones first inclination is to say "That is the organization we finished the war with—it is the best as proved by war. That is what we should adopt."

That is thoroughly unsound.

The Government have accepted the policy that there will be no great war for at any rate some years. We hope very many. On the other hand, there are, or may be, dangers of small wars.

The war left us with many partially solved problems as you know. Surely, the right policy, therefore, is to get the best out of

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the recent war. Settle what organization you would fight in to-morrow if you had to, which God forbid.

Spend the next few years in thought and study and experiment.

Solve the now partially solved problems.

Get the best that science can give, and then settle your permanent organization.

That is how the C.I.G.S. views the problems, and I think few will doubt that he is right. The organization we are adopting is sound for small wars in the meantime if we have any.

During the next few years, therefore, we shall form Experimental Brigades and try out certain changes in tactics.

In the meanwhile we have reorganized our 1st line on pre-war principles and shipped the greater part to the outposts of the Empire.

We are creating an Army Reserve.

We are creating Militia Battalions with which to feed the first line.

We are forming a real Second line in the Territorial Force and bringing it right into the Army. We have also brought home and stored the Mobilization equipment for the above, and supplied our Dominions with the equipment they require.

So a solid frame work has been laid from which we can build as we get wiser. You may say, as some critics say, this is what we should expect of the War Office lack of imagination. But there is a very important factor to be taken into consideration, viz: Finance. We have been strictly limited to 62 millions in all.

When I tell you that the pay takes half of it, you will realize how we have to think of every penny and cannot afford to make a false step.

Suppose we gave you a wrong armament, or introduced a Tank which in a few years would be useless, we should be throwing money away.

We must, therefore, be sure of our ground.

In the building of the future Army there are certain essentials—

(a) It must be better paid.

(b) It must be better educated.

(c) It must be thoroughly efficient and up-to-date.

(d) It must be well housed.

(e) It must be contented.

(f) It must be equipped for civil life on discharge.

All these being attended to—

The pay has been increased.

Education scheme has been introduced.

Staff College has been reopened.

School for N.C.O's qualifying for Commissions is being formed.

O.T.C. is going well.

We owe much to the O.T.C. and Universities. Our alliance grows stronger daily.

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Schools within Army are—

(a) Small Arms, Hythe.
(b) Unified Artillery, main portion Salisbury Plain.
(c) S.M.E.

New Schools—

(a) Physical and Bayonet Training.
(b) M.G.
(c) Anti-gas.
(d) School of Signalling.
(e) Tank.
(f) Anti-aircraft.
(g) Cavalry.

Training.

Very little has been possible so far and very little musketry also. Units have been busy forming themselves, getting to their peace stations, etc. and have been called on for so many extra duties. But that will all come right.

Tanks.

Very little progress has been made so far in organization, but many useful experiments have been carried out with new Tanks and the results are extraordinarily good, showing that time is not wasted in delay which enables one to get a better article.

It has been decided to form two Tank Battalions at once and the cadres of two more.

The Battalions will form part of the Experimental Brigades.

There has been delay in getting permission to take officers into the Tank Corps, etc., but I, personally, have no doubt about the future of these engines of war.

Useful experiments are being carried out with regard to Anti-Tanks.

There are certain people in existence whose sole object in ilfe is to evolve means of destroying every Tank in existence.

Perhaps future Military Tournaments will include such competitions.

Chemical Warfare.

The lessons learnt and the study of this important subject will not be forgotten.

Signals.

We are forming a separate Signal Service, but the details are not yet completed. Progress has been slow and I regret to say that the Signal situation throughout the world is at the moment not good and we are very short of trained experts. Especially wireless.

I am confident that the Signal Service, which has performed such wonderful work throughout the war, has a great future.

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Machine Guns.

The provisional arrangements as regards Machine Guns have been announced in the Press and I will not repeat them here.

The same applies to the Yeomanry and Territorial Army.

In order to complete the latter in Artillery and make the Territorial Army a complete and effective machine we have asked several Yeomanry Regiments to convert into Artillery, while retaining their Yeomanry traditions and identity.

It is clear that with the advent of mechanical means we shall not require the existing 55 Yeomanry Regiments. Many have accepted and others are still considering.

The only other matter I would mention under this heading is the need of comradeship.

Not everyone realizes the value to the nation of the friendships made during these last years. That is the strongest asset the nation has and we must do all in our power to build together and strengthen these links.

There were times perhaps when we spoke of Regulars, Special Reserve, Territorials, etc. as separate institutions. This must not be so in future. We are not only one Army, but one association with all those splendid citizens who fought with us and are now back in the industries of the country.

Our object must be not only to get a contented and happy Army, but to help in getting a contented and happy Nation.

One of the best means of doing this is by games.

In the Army we have made great strides. Realizing the part which games have played before and during the war in enabling our men to keep up their efficiency and moral during those trying days, we have formed throughout the Empire organizations for carrying out our games and constructing grounds, etc. on a sound basis.

Over 500 grounds are now being constructed or re-constructed throughout the Empire so that wherever our soldiers may find themselves, there will be good facilities for recreation.

The Navy are doing the same and I hope the Royal Air Force will follow.

Wherever the Services meet we shall have United Service Grounds.

All our pre-war Competitions have been revised and improved.

The example as regards games and sports, boxing, etc. which the Services are now setting to the nation is very good and the standard of clean and healthy competition a very high one.

I realize as well as you do the defects of what I have put forward.

Many will say "You are wilfully throwing away much of what we have learnt"—I don't think so.

Surely we are not going to forget those lessons.

For the moment the question is entirely one of money.

Even our worst enemies agree that we have played the game over this.

The decision to put the Coast Defences into oil with a few caretakers hits many of you I know, but the Government policy

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is that no one will attack these shores for many years. So we had no other alternative.

Officers are, I know, uneasy about their prospects.
I do not think they need be.
The senior ranks are clearing fast.

Lieut.-Generals, Major-Generals and Colonels are being told quite frankly what their prospects are and the machinery is heavily pressed with resignations.

I will now deal with certain Artillery matters.

1. A Table showing number of Batteries, Companies, etc., in 1914, 11th November, 1918, and in the Post War Army.

Batteries or Companies in 1914.		Batteries or Companies in existence on 11th November, 1918.		Probable Batteries or Companies in post war Army.	
R.H.A. Batteries	25	Batteries	54	Batteries	15
R.F.A. Batteries	147	Batteries	863	Batteries	148
R.G.A. Mtn. Btys.	9	Mtn. Btys.	19	Mtn. Btys. (British)	17
Coys. R.G.A.	98	Heavy and Siege Batteries	540	Btys. R.G.A.	40
Total Units.	107	Fire Commands at Home	81	Fire Commands at Home (incl. 18 Btys.)	29
		Coys R.G.A. Abroad	39	Coast Defence: Coys. R.G.A. Abroad.	28
		A.A. Coys. R.G.A.	48	A.A. Coys.	8
		A.A. Sections	225	R.G.A. (Home)	(nuclei)
		Total Units.	902		85
					37 (nuclei)
				Total Units.	122
GRAND TOTAL (about)	47,000			GRAND TOTAL (about)	42,000

2. We are now practically down to post war strength as regards all the Artillery.

3. At the present time, the problem with which all our Commanders are faced is one of dealing with internal unrest abroad and religious outbreaks than with operations against an organised enemy. For our immediate requirements, therefore, Infantry, Machine Guns, Armoured Cars, and Cavalry are more necessary than Artillery. This state of affairs will not of course last, and whilst tiding over the present difficulties, we aim at organising our Army to meet a future situation

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when we may have again to deal with an organised enemy. Such an enemy may arise in one of two directions—

(a) Middle East.
(b) In Europe.

Of the above, we consider that the Middle Eastern situation is the more threatening, and our immediate concern is, therefore, to organise an Expeditionary Force suitable for use in one of the Middle Eastern theatres.

In such operations Mountain Artillery will assume great importance, and consequently, we have made a start by raising 2 Mountain Artillery Brigades in this country. We are also considering the possibility of increasing the pre-war proportion of T.F. Mountain Artillery. Even so we shall no doubt be short of the quantity required, which may amount to 12 Brigades, but the limiting factor at the present time is the provision of modern equipments which are not available in sufficient numbers. As this defect is remedied, however, it is probable that the proportion of Mountain Artillery in Great Britain will be increased unless the political situation changes. In the meantime we shall have to rely on methods of improvisation from Coast Defences as outlined later.

4. Anti-Aircraft Artillery.

We are confining ourselves at present to experimental and instructional establishments. Our intention is to use the T.F. Organisations for providing the Anti-Aircraft defences in this country. In addition, it will probably be necessary at some future date to provide Regular Anti-Aircraft units for overseas, and to accompany the Expeditionary Force. At present the Air Forces of our potential enemies in the Middle East are not formidable, and for the moment Anti-Aircraft must give way to more urgent calls on our available men and money.

5. Coast Defence.

For the time being the Seas have been swept clear, and we cannot afford to lock up men in Coast Defences at a time when our available resources elsewhere are stretched to the utmost limit. Then again, the system of Coast Defence to be adopted in the future cannot yet be determined, and may not be for several years, though the subject is engaging the earnest attention of the staffs of the three services, Army, Navy, and Air. Until the future is clear, however, we do not wish to scrap defences, to re-establish which might entail great outlay in a few years time.

We hope that in the future it will be possible to arrange for second line T.F. units to take over from Regular Coast Defence units on, or soon after, mobilization, thus setting free the Garrison Artillery for the expansion of the Heavy and possibly Mountain Artillery, in which they served with such distinction during the war. For the time then our policy is:

(a) To store a proportion of the Coast Defences at Home in order to reduce Guards and care-takers, retaining only sufficient to train drafts for Coast Defences overseas, and T.F. Coast Defence Artillery.

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(b) To concentrate the available Garrison Artillery as far as possible, and in addition to training them on Coast Defences, to organise them into Heavy or Mountain Batteries for training purposes.

I fear that this policy must inevitably result in the disappearance of the majority of appointments for senior R.G.A. officers formerly available in Coast Defences. To a certain extent this will be counterbalanced, firstly, by appointing a R.G.A. Colonel to Headquarters of the majority of our Commands at Home, and secondly, by giving to them a proportion of Commands with field unit formations roughly commensurate with the proportion of R.G.A. units; otherwise we should have no senior officers for the higher commands of Heavy Arillery in war.

6. Overseas.

We are adopting much the same principle, i.e.—in every fortress where there are sufficient R.G.A. we propose to maintain a certain number of Mountain or Heavy Batteries, which can be lifted off and sent to join the Field Army as soon as it is clear that their services will not be required in fixed defences. This policy was adopted by force of circumstances during the late war, but we think that far better results will be obtained if all officers and men know that they will have opportunities of service in the field fully equal to those of other Arms, and are organised in peace time accordingly.

The Artillery has now been reduced to what we proposed originally should be its peace strength. It is quite possible, as our garrisons in Mesopotamia and Palestine are reduced, that some further reductions in the Artillery may be necessary, more particularly in the Field Artillery. What this will amount to we cannot now say, and it may be effected either by a reduction of units, or alternatively, by scaling down Establishments. Much, of course, will depend on the European situation, and the necessity or otherwise for making preparations for a war on the Continent.

Then, again, we have by no means reached finality in Artillery materiel. Anti-Tank units may provide a future for some of the Horse Artillery which has been reduced, there may be great developments in Anti-Aircraft and so on.

We must also anticipate a gradual conversion from Horse to Mechanical traction for all classes of guns.

Provided that the Artillery move with the times, there is no reason to fear that the Royal Regiment will play any less prominent part in the future than in the past, though the weapons which it handles may have radically changed.

There is no reason why the Army should keep any but the best. The new pension rules have been framed accordingly, and what all Commanders and Units are urged to do is to get rid of the passengers.

If you had asked me six months ago what the prospects were, I should have shaken my head. Far from it now. I am most hopeful.

I know perfectly well that there are many officers away from

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their units who have not proved themselves in war. Our desire is to get them back and get them reported on.

I am perfectly well aware that the Royal Artillery is more congested than other arms.

The Infantry surplus is now down to 439, and we shall shortly take in some from the waiting list. A Committee has sat recently on the Artillery congestion and I hope certain proposals will be announced shortly. They are not drastic and I think fair.

The work of R.M.A. and R.M.C. during the war deserves special mention. It was wonderful how they kept up their standard. Don't, anyone, think that the prospects are not good and improving.

I grant that the difficulties are great and everyone is feeling that training is hopeless and things are unsettled. There is no standard, no uniformity.

Barracks are bad, things have fallen away. That is all true.

I feel more than I can say regarding the way units have been moved about. Units know exactly what they want. They want to be left alone to reform themselves. Instead of which they are moved about and called on for this and that.

Short of men—short of horses—called on for too many courses. Too much education. Too many returns called for. Too much Staff interference. I know the difficulties, I get them by every post. 50 letters a day.

No sooner does one hope that the Army is going to get a chance than we get orders. Troops to the Rhine. Troops to Plebiscite areas. Troops to Constantinople. Troops to Ireland, etc.

So hard. They are not of our choosing.

It is very hard on those who have taken houses, etc., and every right to think they were settled.

Troops in Ireland are having a bad time.

The same with units in many places.

They are called on to find guards over stores, etc. and doing work of administrative services.

Don't think that these things are not realized and understood. They are.

I can assure you I hold no brief for the War Office, but I tell you frankly that the task of building an Army under the conditions I have described to you is not easy.

The little Army we have, is strung out like a piece of elastic.

All our Commanders at home and abroad are tried men—many of whom have been fighting for years. Men who when they say they must have this and that, their opinions cannot naturally be ignored.

The pressure of work is enormous. The situation in theatres abroad is serious and their requirements are great. Telegrams and letters are still 5½ times the normal.

We have but little to give.

Though recruiting has improved, yet we are short of Signals—especially Wireless. Short of M.T. drivers. Short of Medical personnel, and what is more, the units cannot get a chance to settle down.

One word about the Staff. As some of you know, my one ambition in the war for the Staff and Regimental officers to finish

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as friends. My wish was not altogether granted. Every time I go to the Staff College, I urge the students to go back to their units. The units want them, and what we want is a general utility staff, not a staff brought up in "G" or "A and Q". They must be interchangeable, and in my humble opinion, no Staff officer is, or ever can be, a good staff officer unless he knows and understands troops and their feelings.

I am afraid I have kept you a long time and I thank you for listening to me.

I want you to realize that the task of passing an Army from war to peace is not an easy one, especially when "peace" is not a very suitable term.

I do not even claim that it has been well done. That it has been done at all in the time is a certain satisfaction, and few of you know what work has been put in by subordinate officers to that end. All war worn and tired, and many of whom wounded and invalided who have repeatedly fainted at their posts and in their clubs. My task is easy. I am only the clown that pursues others with a poker but theirs is difficult.

I am fully aware that many mistakes have been made. I am aware that human nature is not studied by some as much as it should be.

But Rome was not built in a day. All that we can hope for is to have laid a foundation stone on which to build. The present Commanders of units cannot hope or be expected to make their units really efficient during their tenure, but if they lay the foundation stone well and truly, there will be no doubt about the future.

It is no secret to say that the C.I.G.S's advice throughout has been "to get out of the scrum" in all these places and look after ourselves and our Empire.

Just as our Allied friends say "Vive la France", we must be pardoned if we say we are very fond of our Empire and want to look after it. It means a lot to us. It took a lot of making.

We have new commitments. Mesopotamia, Palestine, etc. Our outposts are very thin—too thin—and there are signs of unrest in many places. Yet the critics say "You have no right to want an Army. The League of Nations will preserve you." The best sign in the world at this moment is, I venture to say, our firm friendship with France. The firm friendship between Marshal Foch and Sir Henry Wilson. That is a union which means strength and solidity. With the world in its present state we want everything that is solid.

The recent events in Germany give food for much thought.

Many parts of the world are charged with dynamite, though I am a firm believer that there is plenty of common-sense everywhere. There are turbulent minorities everywhere. Some in this country and some in Ireland.

I have not mentioned "Civil unrest" because the Army is not concerned. We have nothing whatever to do with it by Cabinet decision. Our one and only job is to build an Army to maintain our Empire and that is quite big enough a task.

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I look forward to the time when all our Missions and all our troops will be withdrawn from their several places and we can get on with our work.

The Mission under General Holman with Denikin, is a source of anxiety. It has done splendid work and all credit is due to it, but the odds were too great and it can do no more than its duty.

I hope I have not given you a wrong impression. I don't want anyone to go away with the idea that I am pessimistic about the future. I am not. It is not my nature. I have been associated in this war with very human people. Lord Byng, Lord Plumer, Sir Henry Wilson, and I have seen these men making big decisions—always thinking of their troops.

I think the war has made us all more human.

What I have tried to show you is that the situation is difficult. What has been done is wonderful. We have a long way to go yet. The foundation stone of the Army is just laid, but the cement is not yet dry. The future of the Army is good. We have all to put our shoulders to the wheel. We are passing through anxious and critical times—more anxious even than May to August 1918.

Let us eliminate uncertainty and discontent. We want to go forward together and to get everyone to pull the same way on the rope. We want all your help.

All I ask is "Come in and give a shove"! We don't ask the Royal Artillery in vain. That I know well.

DISCUSSION.

THE CHAIRMAN: Are you prepared to answer questions?

GENL. HARINGTON: If I can, if they want to ask any.

THE CHAIRMAN: Would anyone in the audience like to ask Sir Charles any questions; I am sure he will be delighted to answer them. (After a pause). I would like to ask one thing if I may. You spoke of amalgamation of the North and South Down Militia. Can you tell us anything about the amalgamation of the Royal Artillery?

GENL. HARINGTON: I will tell you what I have brought down with me—it is no secret. What was the particular point you wanted to get at, the number of the batteries?

THE CHAIRMAN: Is the amalgamation going to come off or not?

GENL. HARINGTON: You mean the Byng Report?

THE CHAIRMAN: Yes.

GENL. HARINGTON: No, that has not been settled yet; it has not been even considered by the Army Council yet. The difficulty at the present moment is that you have to build something that is going to keep you going for the time being. I do not think we know enough. I do not think the experience of the War is enough for anyone to make a decision like that at the present moment. I do not know what the gunners think.

GENL. WHITE: Speaking of training can you say when training will begin again—practice camps and that sort of thing, from our point of view?

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GENL. HARINGTON: It depends on the money. I do not know whether any gunners want to go down to practice camps this year. I can tell you very little. What we are trying to do is to form an experimental Brigade first of all. From our point of view, taking machine guns and tanks together, it would not take a great deal of money but I do not think it will begin till towards the end of the year. I should think there are very few Territorials who will go out to camp this year, so that there will be a certain amount of saving there. If we can get the money for them to go there is no reason why it should not be used if they are in a state to go.

GENL. SIR NOEL BIRCH: As a matter of fact you have not any training grants this year.

GENL. HARINGTON: Very little.

CAPT. ROBINSON: Can you say if the name Special Reserve is going to disappear?

GENL. HARINGTON: That is not settled—possibly it will be called Militia. Lots of people write to say it is a mistake to change. That is how it stands.

THE CHAIRMAN: Ladies and Gentlemen, I think nothing now remains but to express our most cordial thanks to Sir Charles Harington for his extremely interesting and extremely valuable Lecture. We owe a great deal to him; he is one of the busiest men I suppose in the War Office—not at this moment a very idle spot—for finding time to come down on this mission, and I think we all agree that it is of most extraordinary value to us outsiders to have information of this kind given to us so that we may know what is going on behind the scenes. It clears up a thousand misunderstandings and things of that kind. I think the Lecture we have listened to to-day has been extraordinarily well adapted in that way to show us at the same time the difficulties of those in high office and how those difficulties are overcome, and how the welfare and well-being of the troops are really at the bottom of everything, however little many of the troops themselves may appreciate it at the time.

I think we gunners can be particularly grateful to Sir Charles Harington for coming down. Many of you have known him during the War. I had the pleasure of being very intimately associated with him in the old Second Army, and I can assure those who are not aware of the fact that the gunners had no better or more loyal friend in France than Sir Charles Harington. (Loud Applause).

GENL. HARINGTON: Thank you very much for what you said.

There are two points that I had wanted to mention which have been before me lately. One has to do with the Guards Division which I did not mention, and the other with the Artillery and the Infantry. Upon the first, whether there is to be a Guards' Division, we have got a decision. I say No, straight. I am talking as an Infantry soldier. Two things in this War stand out in my mind. One is what we Infantry soldiers learned before the War and during the War from having Guardsmen actually in our Divisions. I know what we learned from them during the War and the help they

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gave us for instruction of every kind. It would be a fatal mistake to put that away—the rest of the Infantry gains very much by it.

And the other lesson is the extraordinary comradeship and co-operation between the Artillery and the Infantry. As an Infantry soldier in this room I tell you that nobody appreciates it more than I do and my colleagues in the Infantry. Those two things I want to see stick close together. (Prolonged applause).

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THE ORGANISATION OF THE BATTERY SIGNALLERS IN A SEPARATE SECTION.

By Major J. B. Walker, d.s.o., R.G.A.

THE formation of a fourth section consisting of other specialists who constitute the battery staff is advocated for the following reasons:—

(a) One thing we always teach in the artillery is that "The Section Commanders and Nos. 1 are the keepers of their men's welfare under all circumstances, their trainers for the fight and the commanders of their men in action."

If signallers are split up amongst the gun sub-sections, the "keepers of their welfare" are the section commanders and Nos. 1 who look after their clothing, housing, feeding, games, etc. Their "trainers for the fight" are the subaltern who was known as Reconnaissance or observation officer assisted by the N.C.O. i/c signallers; yet these two are not responsible for the efficiency of the signallers horses and saddlery, while they are for the state of their signalling equipment. "Their commanders in action" are always, except when a section is detached, the Reconnaissance officer and the N.C.O. i/c signallers.

From the above the dividing up of the signallers among the gun sub-sections is illogical, and they should be collected together in a separate section.

(b) In barracks, if all the signallers live together in one room, practice on the buzzer, etc. can be done without being disturbed by other men. If they are to live together they should belong to the same section.

(c) In peace time with signallers in the gun sub-sections the position of the Nos. 1 as regards detailing the signallers of his sub-section for fatigues and duties is never clear, as the signallers serve two masters, their own Instructor and their No. 1.

(d) With signallers in gun sub-sections in peace time, the signalling instructor frequently wants men for extra training at stable hour when their No. 1 wants them at stables. If the signallers formed a separate section with their horses, the signalling instructor could arrange for the training of backward men at stable hour while the better trained men did stables.

In war, heavy batteries were supposed to have 31 trained signallers. This should allow of men resting and they could look after the signallers horses.

(e) In peace time, with a separate signallers section, this

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No. 4 SECTION WAR STRENGTH.

(6″ How. or 60 pr. Horse-Drawn Bty.)

	'G' Sub.				'H' Sub.				TOTALS.			
	Personnel.	Riding and L.D. Horses.	Motor Cycle.	Box Car.	Personnel.	Riding and L.D. Horses.	Motor Cycle.	Box Car and Mess Cart.	Personnel.	Riding and L.D. Horses.	Motor Cycle.	Box Car and Mess Cart.
Major	1	2	...	...	...	...	...	...	1	2		
Captain	...	...	...	...	1	1	...	...	1	1		
Subaltern (R.O.)	...	...	...	...	1	1	...	...	1	1		
Bty. Sgt. Maj. and B.Q.M.S.	1	1	...	...	1	1	...	...	2	2		
Farrier Sgt.	1	1	...	...	...	...	...	...	1	1		
Fitter Staff Sgt.	...	...	...	...	1	...	...	...	1			
Trumpeters	?	?	...	...	?	?	...	...	?	?		
N.C.O. i/c Sigs.	1	1	...	...	...	...	...	...	1*	1		
Bty. Cmdrs. Asst. (B.C.A.)	1	1	...	...	...	...	...	...	1*	1		
R.O's. Asst. (R.O.A)	...	...	...	...	1	1	...	...	1*	1		
Horse-holders for B.C., Capt., R.O. and R.O.A.	1	1	...	...	2	2	...	...	3*	3		
Horse-holders for N.C.O. i/c Sigs. and B.C.A.	1	1	...	...	...	...	...	...	1*	1		
'A' Group Sigs. and H.H.	6	5	...	...	...	...	...	...	6*	5†		
'B' Group Sigs. and H.H.	...	...	...	...	6	5	...	...	6*	5†		
Despatch Riders	1	...	1	...	1	...	1	...	2*		2	
Spare Signallers, Linesmen and Spare Horses	5	...	...	...	5	2	...	...	10*	2		
Box Cars and Mess Cart	1	...	...	1	2	1	...	2	3	1		3
Pay Clerk, B.S.M. Clerk and B.Q.M.S. Clerk	2	...	...	...	1	...	...	...	3	...		
N.C.Officers for drawing rations and for supervising messing and forage issues	1	...	...	...	2	...	...	...	3	...		
Batmen	2	...	...	...	2	...	...	...	4	...		
TOTALS	25	18	1	1	26	14	1	2	51	27	2	3

* 31 Trained Signallers.

† The above number of horses is as laid down in the training manuals. War Establishments do not allow this number (they allow 7 too few), but it is presumed they will be amended to agree with the training manuals.

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section could be detailed to find all guards and duties for a certain number of consecutive days and this would interfere with their training far less than constantly having two or three men away on duty as may happen with the signallers split up among the gun sub-sections.

(f) In war as the signallers of the Battery staff are responsible for all communications, it is convenient to have them grouped at Battery Headquarters rather than split up among the gun subsections.

In barracks or the field it is easier for the N.C.O. i/c signallers to detail duties for the following days work and to make last minute alterations due to sickness, etc. if all the signallers not away on duty are together and not split up in gun subsection, messes, and billets.

It might be advisable to include in this extra section the B.S.M. B.Q.M.S., their clerks, the ration N.C.O., the N.C.O's i/c messing and forage, and the Staff-Sergeant Artificer, as they are directly responsible to the Battery Commander, and their work concerns the whole battery rather than any special individual subsection. Consequently they should be billeted near the Battery Commander.

Next we have to consider the objections that are advanced against forming the signallers into a separate section and see if they can be answered:

(a) Such a section would always be designated by the rest of the battery as "The Staff" or privileged ones and would always be suspected of doing less work and getting better rations, etc. than the other men.

The formation of a separate signallers section would not really make much difference as even now certain persons such as the B.S.M., B.Q.M.S., cooks, batmen and others are frequently known as "The Staff" and suspected of all crimes. Still it is important to give as little cause as possible for this by avoiding calling this section "Battery Staff" or "Headquarters Section". There is a lot in a name, so call it "No. 4 Section" or something like that and make it do its full share of duties (see para 1 (e) above) and make cooks from the gun sections be present at the cutting up of the rations, etc. to assure themselves that they get their fair share.

(b) If signallers are split up amongst the gun sections, each section would always be ready organised with its staff and could easily be detached complete with signallers.

This is not correct. Signallers are now organised in groups, 'A' and 'B', three men and two horse holders in each group being mounted. It is not possible to split these horses up in such a way as to give each of the three sections a complete mounted group, and the necessary equipment. But with the signallers organised in a separate section the Battery Commander would merely order 'B' group, with or without the Reconnaissance officer and his assistant, to accompany the section to be detached.

With signallers split up among the gun sections frequent reposting of personnel is necessary as new men become trained, etc., to ensure each section having an equal number of good signallers. This means that Nos. 1 often have changes in their personnel. But with signallers in a separate section, rearrangement of the men in the various groups within the section only is entailed.

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In peace, during section training, a signal group could always be detailed to parade with a section when required.

(c) Signallers are useful to supplement gun detachments in the event of large casualties. For this reason it is better for signallers to belong to gun subsections as their Nos. 1 will know them.

It is doubtful if it will be possible to spare highly trained men for this and they may not be on the spot when required, even if they do belong to gun subsections. If it were at any time necessary for signallers to reinforce gun detachments they could be lent by No. 4 section, the least trained signallers being used for this purpose; while if the signallers belonged to gun subsections it might happen that the best signallers were taken, because they belonged to the subsection requiring reinforcement, to the detriment of communications.

(d) In peace time, No. 4 section would not be strong enough to have section teams at games and good section teams do keep up "*esprit de section*".

This is true, though No. 4 section could have subsection teams. For games only some B.C's might prefer to divide the men of No. 4 section amongst the other sections.

The writer has been both section officer and Reconnaissance officer before the war in units which maintained a large number of well trained signallers. He used not to believe in forming a separate signallers' section though other batteries in the brigade did so. He is however quite converted to this system.

It is open to question whether No. 4 section should or should not be split into two subsections. A possible organisation is given below showing No. 4 section as a whole and split into two subsections.

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THE HEAVY BRIGADE AFTER THE WAR.

By Major J. L. Forbes, D.S.O., M.C., R.G.A.

IN the January number of the Journal Lt.-Col. Phipps, in the course of an article with most of which almost all R.G.A. officers will agree, draws certain conclusions which call for a protest.

He states that "The F.W.D. draws a howitzer at infantry pace or at a pace rather faster than infantry", and that in long moves carriages get damaged by going too fast, and that guns and ammunition lorries have to move at different paces. All this is quite true, but is the remedy to make the guns and first line vehicles slower by putting them behind horses? Is it not rather to make guns and carriages more mobile by improvements in design, of which rubber tyres might be one, so that guns and lorries could move together at the higher speed and if necessary do their hundred miles a day for several days in succession without great fatigue, instead of being condemned to foot pace behind horses.

As for lorries being taken away from batteries by Corps to bring up ammunition (and other things) this could be avoided by having proper ammunition columns.

Col. Phipps draws a harrowing picture of a B.C. and an enormous tail on reconnaissance. In plain fact this difficulty hardly arises. From Arras to the neighbourhood of Valenciennes one car and one motor cycle were all I used myself and I found them quite sufficient. The chief disadvantage of trusting to the battery car in France was that every assistant staff captain and parson at any H.Q. considered that he had first claim on every battery car to save his own or his horse's legs on his ordinary work, to take his august person on leave, or to go to lunch at the Hotel du Rhin or the Sauvage, and for some unknown reason was allowed to take it, regardless of the work it was wanted for by its battery. Other disadvantages are that a heavy car cannot be taken over bad roads without fear of damage, while such cars as Fords cannot carry good loads of wire etc. in addition to the B.C. and his necessary satellites. Again no car can go over really bad ground.

Objection number one can probably, and number two certainly, be overcome by issuing batteries with light vans such as the Fords used in Mesopotamia. These would also be a great boon and economy for rations, canteen stores, etc. The third is undefeatable at present, but a van such as is suggested would go practically anywhere where ammunition could be delivered, even by horse transport.

Col. Phipps gives five postulates.

(1). We hope to get a better tractor at some time in the future.

(2). We mean by a better tractor one which will take guns over

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rough or soft ground, will enable a battery to march as a complete unit with infantry, will draw ammunition as well as guns, so as to provide for the replacement of gun tractors which may be put out of action, and will be capable, if possible, of accelerated speed, in order to move batteries more quickly from one part of the front to another.

(3). We cannot plunge on a new tractor without spending some time in experiment.

(4). We want to come to some improved arrangement for the present time.

(5). A temporary arrangement demands economy.

Which supply the best means of transport for officers and battery staff? Horses or cars or motor-bykes? Surely at all times, cars and motor-bykes, supplemented occasionally for reconnaissance by legs. Certainly horses or ponies would be useful sometimes, but they are not necessary, and with a battery equipped according to these suggestions they could never keep up.

Which are best for guns at present? Surely F.W.D's, which could move batteries with improved carriages long distances at a good speed. In moving warfare in Europe it will seldom be necessary to move far from roads, while in siege warfare we managed very well in France.

Which is best for ammunition? Undoubtedly the lorry, supplemented when necessary by the methods used in France.

Therefore I suggest the following solution, laying stress on the fact that it is temporary and inexpensive, because it involves simply an issue of F.W.D's vans, and lorries already in possession of the army, the sale of a number of horses which now cost a lot to feed, and the reduction of a large number of men now engaged in looking after horses.

In all 60-pr. and 6″ How. batteries.

(a) Officers and battery staff to have motor transport on a rather different scale to that in a 6″ How. Battery.

(b) Guns and Hows. to be equipped for rapid movement and drawn by F.W.D's.

(c) All ammunition and stores on lorries.

Battery ammunition columns would appear to be quite unnecessary but Corps or perhaps Brigade Ammunition Columns might with advantage be formed.

As regards the remainder of the article, few will disagree with Col. Phipps, but I would suggest that a better and shorter definition of the business of the artillery would be "So to employ its different natures of guns as to give the greatest possible assistance to the other arms of the service in carrying out the commander's plans".

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THE DANGER ZONE OF 18-Pr. SHRAPNEL.

By Lieut. (D.O.) F. Ahl, R.A.

THE problem of engaging targets to which our infantry are close, and the question of how far behind the mean point of impact of a barrage the infantry must be to ensure safety from our own fire, are two very important points which a gunner is often called upon to solve or answer, and frequently the information is required at short notice.

The distance from a mean point of impact that will ensure a reasonable margin of safety for our own troops, depends largely upon the nature of ammunition used, and, where the projectile selected is one that is burst on percussion, the solution of the problem is easily obtained from the range tables, using the 50% Length Zone as the basis for the calculation.

It is much more difficult where time sharpnel is the projectile, in this case, the safety distance is determined by the fall of the shortest bullet from the shortest air burst, the position of the latter depends first, on the height of burst selected to give best results on the target, and secondly on which trajectory of the 100% Length Zone the shortest burning fuze happens to travel.

With a view to determining the worst possible cases that are likely to occur with Q.F. 18-pr. Shrapnel, calculations were made to find the fall of the shortest bullet.

(i) With the mean point of burst of fuzes on the line of sight.

(ii) With the mean point of burst of fuzes 10′ above the line of sight.

The argument being that if the fall of the shortest bullet be calculated from theoretical data, and a margin allowed for possible variations due to service conditions, the danger spaces thus determined would be useful as a guide to Battery Commanders etc.,

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when considering the safety of our own infantry. The information could conveniently be included on a back page in the Range table in graphical form.

In making the calculations the following conditions were assumed:—Q.F. 18-pr. M.V. 1615 f.s. using Shrapnel Fuze T & P 80, weight 18½ lbs., normal atmospheric conditions.

The mean error in time of burning of the fuzes, have been taken from "specification, mean errors", permitted by the Controller of Munition Design for fuze settings:—set full, set 16, set 11; and the mean error for set 5, from a value given by the Superintendent of Design, Royal Arsenal, as a result of experiment. The mean errors are as under:—

Mean Errors of T & P Fuze No. 80.

Fuze Set.	Range from Range Table. 40/W.O./6772.	Mean Error.
21·7	6500	0·14 secs.
16	5050	0·11 ,,
11	3633	0·11 ,,
5	1666	0·087 ,,

For the purposes of calculation, the mean errors have been plotted against ranges, and the result smoothed into a straight line, it being contended that this will give a very fair probable value of the mean errors at various ranges.

The results arrived at are set out in Table facing page 78 under two sub-headings.

(i) For the shortest air burst occurring on the mean trajectory.

(ii) For the shortest air burst occurring on the shortest trajectory.

The reason being that although the chances are much in favour of the shortest burst occurring on or about the mean trajectory, there is the possibility of it occurring on the shortest trajectory; it is just this possibility that makes the worst case.

Given the same fuze setting, under normal conditions, and the fact that the shell may travel on any trajectory, the main factors determining the range to the burst are (i) time of flight, (ii) rate of burning of fuze composition, and as we are considering the quickest burning fuze only, the variable factor will be time of flight, this being principally affected by variation in muzzle velocity.

The worst case to be considered is therefore, where the shortest burst occurs on the shortest trajectory, where the latter is due entirely to a variation in Muzzle Velocity.

This has been assumed, and from the "Reports on Experiments" in Quarterly Summary of Artillery Information No. 2 of 1919, it seems quite reasonable.

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Table of Distances for 18 pdr. Shrapnel.

Remarks.	Mean Point of Burst on Line of Sight.										Mean Point of Burst 10 mins. above Line of Sight.									
	Mean Trajectory.					Shortest Trajectory.					Mean Trajectory.					Shortest Trajectory.				
	Elevations on Elevation Indicator.																			
	2000	3000	4000	5000	6000	2000	3000	4000	5000	6000	2000	3000	4000	5000	6000	2000	3000	4000	5000	6000
Ranges to graze pern. yds.	2000	3000	4000	5000	6000	1956	2938	3924	4910	5900	2000	3000	4000	5000	6000	1956	2938	3924	4910	5900
Deduced M.V. of round. f.s.	1615	1615	1615	1615	1615	1590	1586	1584	1581	1580	1615	1615	1615	1615	1615	1590	1586	1584	1581	1580
Range to mean burst. yds.	2000	3000	4000	5000	6000						1916	2929	3939	4947	5954					
Range to shortest air. yds.	1893	2887	3886	4886	5888	1872	2865	3861	4859	5858	1803	2814	3824	4832	5840	1786	2792	3799	4802	5805
Height of shortest burst. feet.	19·4	39·2	61·6	88·2	121·3	15·2	24·9	33·5	37·7	44·7	34·0	62·4	93·5	128·7	174·1	29·2	48·9	66·1	79·9	99·0
Range to shortest bullet. yds.	1921	2931	3945	4948	5935	1893	2893	3891	4885	5882	1852	2886	3909	4925	5939	1838	2847	3858	4858	5859
Distance short of M.P.I. of shortest bullet. yds.	80	69	55	52	45	107	107	109	115	118	148	114	91	75	61	172	153	142	142	141

The above information is shown graphically on accompanying diagram.

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Mean point of burst on line of sight.

The most important occasion from a safety point of view where the above mean burst is used, is probably during a time Shrapnel creeping barrage. Perhaps it would not be out of place to discuss some of the results arrived at.

It is interesting to compare the differences between results on mean and shortest trajectories with regard to the M.P.I.; these differences are set out in the following table:—

	Shortest air burst. Yards.		Shortest Bullet. Yards.		Distance from shortest air to shortest bullet. Yards.		Height of shortest air burst. Feet.	
	Mean.	Shortest.	Mean.	Shortest.	Mean.	Shortest.	Mean.	Shortest.
2000	−107	−128	−80	−107	27	21	19	15
3000	−113	−135	−69	−107	44	28	39	24
4000	−114	−139	−55	−109	59	30	61	33
5000	−114	−141	−52	−115	62	26	88	37
6000	−112	−142	−45	−118	67	24	121	44

The uniformity of the distances short of the M.P.I. of the shortest air bursts is explained by the balancing effect of high remaining velocities combined with small error of fuze at short ranges, and vice versa. The disparity in distances short of M.P.I. of shortest air bursts and the greater disparity of fall of shortest bullet on the mean and shortest trajectories is occasioned by:—

First, the shortest trajectories are calculated for lower M.V. than the mean trajectory, but for the same angle of projection, consequently the shortest trajectory will be lower than the mean at the target end, and the range for a given time of flight will be less. Therefore, the shortest air on the shortest trajectory will be shorter and lower than if it occurred on the mean.

Secondly, the inclination of the shortest bullet to the horizontal being practically the same on both trajectories it is obvious that it will not travel so far forward in the lower and shorter trajectory. This will be clearly seen on accompanying graph.

With regard to the safety distances short of M.P.I. it is not the intention to suggest that infantry should move at a greater distance in rear of the M.P.I. of a barrage than at present, but rather to look at the question from its technical side.

Taking the above distances for shortest bullet on shortest trajectory as a guide, and adding say 10% for safety, as when considering close shooting and percussion, and taking a round figure, a distance of say 130 yards at all ranges in rear of M.P.I. would seem to give a very reasonable margin of safety to our own troops.

Bearing in mind that this distance is calculated for the worst case, with a good margin for safety, that the chances are very much

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against the shortest burning fuze travelling on the shortest trajectory, and that when this trajectory is not entirely due to a loss of M.V. the point of burst of the shortest fuze will be further up the range, the actual risk seems even less.

The 50% Fuze Zones work out at:—

Ranges.	2000	3000	4000	5000	6000
Ranges.	200	3000	4000	5000	6000
50% Zone. Yards.	53·5	56·5	57	57	56

The possible 100% Fuze error zone as viewed from the gun, ranges between graze and the shortest air burst occurring on the longest or highest trajectory.

The heights of the zone in minutes at the various ranges are:—

Ranges.	2000	3000	4000	5000	6000
Height. Minutes.	14	21	26	30	38

Mean point of burst 10′ above line of sight.

An inspection of the results given under the above heading shows that the distances between the mean points of burst and shortest air bursts are practically the same as with a mean point of burst on the line of sight, but that the distances of shortest airs and shortest bullets from the mean point of impact are not nearly so uniform.

Distances short of M.P.I.

	Shortest air burst. Yards.		Shortest bullet. Yards.	
	Mean traj.	Shortest traj.	Mean traj.	Shortest traj.
2000	−197	−214	−148	−173
3000	−186	−208	−114	−153
4000	−176	−201	− 91	−142
5000	−168	−198	− 75	−142
6000	−160	−195	− 61	−141

The reason being that as the range increases the mean point of burst is placed closer to M.P.I. consequently the shortest air bursts and shortest bullets will conform.

The differences between the fall of the shortest bullets with respect to M.P.I. at 2000 and 6000 is too great to smooth out, but by taking the worst case, that for 2000, adding 10% for service conditions and taking the safety distance as being 190 yards at all ranges, a good margin for safety is assumed at the mean and longer ranges.

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The 50% Fuze zones work out at:—

Ranges.	2000	3000	4000	5000	6000
50% Zone. Yards.	56·5	57·5	57·5	57·5	57

The slight increase as compared with those for a mean point of burst on the line of sight being due to the greater remaining velocity. From the above 50% Zones and the distances of mean points of burst from mean points of impact, the following percentages on graze were calculated:—

Ranges.	2000	3000	4000	5000	6000
% on Graze.	2·5	5·0	7·5	11	14

This bears out the generally accepted fact that with a mean height of burst of 10 minutes above the line of sight that 10% on graze can only occur at a mean range, and that the percentage is very small at short ranges and larger at the longer.

The heights that would contain 100% of bursts as viewed from the gun, expressed in minutes are as under:—

Ranges.	2000	3000	4000	5000	6000
Height in minutes.	24	30	36	41	48

The line taken and arguments are set out in the following Appendix:—

Appendix.

The calculations are based on information given in the Range Table for 18-pr. Q.F. (40/W.O./6772) and the formulæ used are taken from Ballistic Tables 1910.

A summary of information, formulæ, and results is given in the following Tables.

The first step was to find the Ballistic Co-efficient to use for subsequent calculations. The values of C were extracted from the Ballistic Tables, using the formula Sin 2 ϕ = CA with the recorded results given in the Range Table; i.e. MV 1615 f.s. where $\phi = 7^{\circ}\ 33'$ Range = 4000 yards &c.

Values of C obtained:—

Range	—	2000	3000	4000	5000	6000
C	—	1.79	1.81	1.83	1.85	1.88

These values of C were used throughout.

The next step was to calculate the times of flight for these ranges, because times of flight for the short trajectories must be calculated, and better results might be expected by the comparison of two calculations, than by taking one time of flight from Range Table and calculating the other, although the difference is very small, the maximum being 4/100ths of a second.

The deduced M.V. of the shortest round at the same ranges was next found from the Range Table by interpolation, it being assumed

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0′ ABOVE LINE OF SIGHT.

	TORY 1615 f.s.			SHORTEST TRAJECTORY.				
	000	5000	6000	2000 1590 f.s.	3000 1586 f.s.	4000 1584 f.s.	5000 1581 f.s.	6000 1580 f.s.
Range to M.P.B.	939	4947	5954					
T. of F. to M.P.B. (t = C	615	14·224	18·227					
½ 100 °/₀ Fuze Zone.... ...	80	·417	·454					
T. of F. for shortest Fuze (t −	235	13·807	17·775					
do. (t − 1·2°/₀ M.V.)				4·124	7·034	10·273	13·863	17·841
Range to shortest air burst Yards. ... ... (= t′	24	4832	5840	1786	2792	3799	4802	5805
Inclination of Trajectory at burst. (= ta	34′	14°5′	19°26′	3°0′	6°1′	9°48′	14°23′	20°6′
Height of Trajectory at Shortest burst. ($\frac{y}{x}$ = t	3·5	128·7	174·1	29·211	48·911	66·105	79·963	99·092
Remaining Velocity at Shortest burst. (= U c	015	849	800	1108	993	910	846	799
Inclination of shortest bullet to Horizontal. (θ plus	4′	24°50′	30°26′	13 0′	16°16′	20°18′	25°8′	31°6′
Velocity of shortest bullet at burst. (R.V. c	015	949	900	1208	1093	1010	946	899
Range to shortest bullet. (Range	909	4925	5939	1828	2847	3858	4858	5859

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that the rounds falling at the short end of the 100% Length Zone were due to a loss of Muzzle Velocity.

		2000	3000	4000	5000	6000
M.V. of shortest round.	f.s.	1590	1586	1584	1581	1580

Having found C, time of flight, and M.V., the remaining calculations are given in sequence as follows:—

Notes on the above tables:—

Time of flight for shortest burning fuze.

Using the mean error already given for T & P Fuze 80, the shortest fuze would theoretically speaking burn for a time equal to the time of flight to the mean point of burst minus half the 100% fuze zone (M.E. × 1.69 × 2) on the mean trajectory.

With regard to the shortest trajectory, as it has been assumed that although fired at the same elevation from the same gun, the shortest trajectory is due to a loss of M.V., an allowance must be made for decreased pressure on fuze composition due to this, because the time of burning will be increased thereby.

Information was circulated some time ago that for a loss of 100 f.s. the rate of burning was decreased by 1.2% at 3,500 yards, in the absence of further or fuller data this allowance has been applied proportionally at all ranges.

Range to shortest air burst.

In this and all other calculations for the shortest trajectory the following deduced M.V's were used:—

Ranges	2000	3000	4000	5000	6000
M.V's.	1590f.s.	1586f.s.	1584f.s.	1581f.s.	1580f.s.

Remaining Velocity.

These are all over 400 f.s. (the knock-out velocity for 18-pr. shrapnel bullet).

Note.—100 f.s. has been added for increased velocity due to opening charge.

Angles of Opening of 18-pr. Shrapnel Shell.

These are taken from "Shrapnel Effect" by Captain Hill, (1913) and are as under:—

Ranges—

	2000	3000	4000	5000	6000
Angles of Opening	20°	20½°	21°	21½°	22°

Range of shortest bullet after burst.

This has been calculated as though the bullet followed a straight line to the ground, the error in range is negligible, as at the short distances involved, the influence of gravity is so little that the trajectory of the bullet is practically straight.

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BETTING AND BRACKETS.

(An Article without an X)

By Capt. D. R. D. Fisher, d.s.o., R.F.A.

PART I.

MOST officers in the Royal Regiment are at least mildly interested in backing horses and laying the odds, in the chances of holding four aces and the probabilities of roulette; but few realize the ample scope for their gambling propensities that exists in the exercise of their profession. It is in the hope of arousing interest in this neglected aspect of the Rules of Ranging, in themselves so stereotyped as to savour rather of tradition than of reason, that an attempt has been made to express them in terms of starting-price odds.

Let us first examine the question of odds in their popular sense; not from the point of view of racing, for that introduces such complications as the bookie's margin, but from the point of view of cards. Given a well shuffled pack, what is the chance of cutting any particular card, say the ten of clubs? Since we are trying to cut one of fifty-two cards, the odds against our succeeding are obviously 51 to 1, expresing our expectation of 51 failures for 1 success. But although this form of expresion is hallowed by custom, it is not the only one, and for our present purposes it is not the most convenient; it is equally sound to express the odds, not in the form of "failures to successes," but in that of "successes to attempts": since we expect 51 failures for 1 success, we expect 1 success in 52 attempts, and this can be written as a fraction, either vulgar or decimal. Our chances of cutting a named card out of a full pack are thus 1/52 or ·019. The reason for adopting this form will appear in a moment.

Now suppose I have two packs of cards and back myself to draw a named card from each pack; what are the fair odds to give me? The odds in each case are undoubtedly 51 to 1; but what are they in the two cases taken together?

The question is apt to be confused with a 'racing double'. In ante-post betting, if I have a sovereign on a double, the horses standing at 10 to 1 and 5 to 1 respectively, I stand to win £50; i.e. the odds of the double are 50 to 1—from the bookie's point of view. But these are not the true odds, as we may see by regarding the bet as an 'accumulator.' If the first horse wins, my £1 has £10 added to it, and becomes £11; if the second horse wins, this £11 at 5 to 1 has £55 added to it and becomes £66, which includes my original £1 stake. My sovereign therefore should stand to win me £65; in other words, the odds I am entitled to are 65 to 1.

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(It may be stated in parenthesis that the bookie's point of view is easily understood. Doubles cramp his style, since they prevent him making up his book on the second race until the first has been run. In those rare cases where it is possible to persuade him to accept a double accumulator, his method of calculation is to multiply and add; in the present example $10 \times 5 = 50$; $10 + 5 = 15$; $50 + 15 = 65$; 65 to 1).

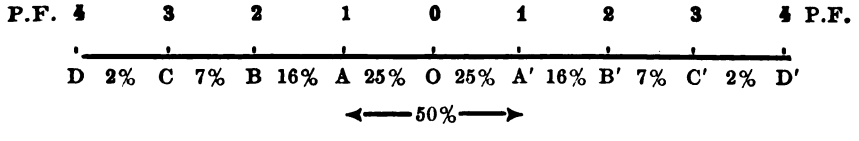
All this may appear rather complicated, but by adopting our suggested method of stating the odds we may greatly simplify these calculations. Odds of 10 to 1 and 5 to 1 we should write as $\frac{1}{11}$ and $\frac{1}{6}$; $\frac{1}{11} \times \frac{1}{6} = \frac{1}{66}$ which is our way of saying 65 to 1, and the whole business is done in one motion.

Let us return to our muttons—our two packs of cards. Here the odds in each separate case are 51 to 1 or $\frac{1}{52}$; the combined odds, i.e. the odds of complete success, are therefore $\frac{1}{52} \times \frac{1}{52} = \frac{1}{2704}$; in popular parlance 2703 to 1. But these large fractions are rather clumsy, and we shall find it more convenient to use decimals; in this case $\frac{1}{52} = \cdot 019$ and the chance of complete success is $\cdot 019 \times \cdot 019 = \cdot 00036$. The use of the decimal form of expression has the added advantage that it enables the chance of success to be illustrated graphically.

We may perhaps venture to state, without attempting any formal proof, that what is true of two independent events is true of any number; that if the individual chances of say four events happening are $\frac{1}{m}, \frac{1}{n}, \frac{1}{p}$, and $\frac{1}{q}$, the chance of them all happening is $\frac{1}{m} \times \frac{1}{n} \times \frac{1}{p} \times \frac{1}{q}$. For example since one's chance of dying on any particular day of the week is $\frac{1}{7}$ (there being seven equally convenient days for departure) the chance that Tom, Dick, Harry, and I all die on the same day of the week, say a Monday, (but of course not the same Monday) is $\frac{1}{7} \times \frac{1}{7} \times \frac{1}{7} \times \frac{1}{7} = \frac{1}{2401}$ or 2400 to 1 against; odds so long that Death is robbed of half his sting!

One further point must be cleared up before we can get properly started; we must tackle the vexed question of Probability Factors. It is popularly supposed that they are the mystic symbols of the cult of Higher Gunnery, and of no interest to any but the elect; it is not generally grasped that they are not peculiar to the cannon and its fall of shot, but are applicable to every form of statistics from the birth rate in Honolulu to the incidence of rabies in the Isle of Dogs: they are merely convenient divisions of distribution. Consider the 100 per cent zone of the gun to be divided into 8 equal parts, (Fig. 1). The probability factors tell us what percentage of a group of rounds fired under the same conditions may be expected to fall in each part.

Fig I. The Probability Factors.



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For example AA (Probability Factor = 1) contains 50%; and since the group is theoretically symmetrical about O, the centre or M.P.I. of the 100% zone DD′, AO and OA′ each contain 25%. BB′ (P.F = 2) contains 82%; BA and A′B′ therefore each contain $\frac{82-50}{2} = \frac{32}{2} = 16\%$. In other words, the Probability Factors enable us to find out what percentage of a group of rounds we are entitled to expect in any particular portion of the 100% zone.

Now let us introduce a target into the picture. Suppose that the target is at D; our line is known to be correct and we fire a round. What is our chance of a 'Plus'? Bar accidents and prematures, no round can fall short of D, which is the near end of the 100% zone; and D is a theoretical point, and as such immune from direct hits. Every round therefore must be a 'plus', and the chance of getting a 'plus' is a certainty, or unity, or 1; since a 'plus' will be obtained once in one time, which is every time.

But suppose the target at B (P.F. = 2); BB′ contains 82% of the rounds, therefore DB will contain $\frac{100-82}{2} = \frac{18}{2} = 9\%$ of the rounds. In other words out of every 100 rounds fired, 9 will fall in DB and 91 in BD′; i.e. out of every 100 rounds 91 will be plus of B, and the chance of any one round falling plus of B is $\frac{91}{100}$ or ·91.

In this way it is easy to work out the chance of getting a 'plus' of any point in the 100% zone DD′: and it is obvious that we have a certainty of obtaining a 'plus' on any target short of D, and no chance at all of getting one if the target is beyond D′; i.e. the chances in these two cases are 1 and 0 respectively.

We can now embody all these chances in a diagram (Fig. 2) in which the base represents the 100% zone of the gun, and the perpendiculars represent, on any convenient scale, the chance of getting a 'plus' on a target at various points in the 100% zone. If we work out the chances at 9 such points, corresponding to the 'whole number' Probability Factors, and join up the tops of their respective perpendiculars by straight lines, we get a very fair imitation of a scientific curve; squared paper would give us a prettier picture, but this is good enough for us.

The Chances of a 'Plus'.

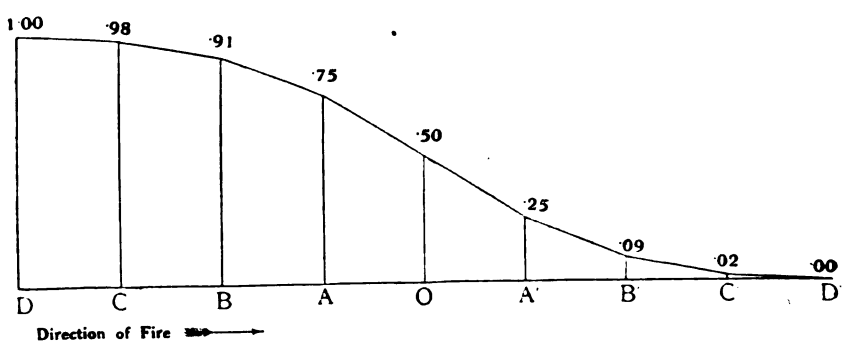

Fig. 2.

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Now what about the chances of a 'minus'? When the target is a theoretical point, every round must be either a 'plus' or a 'minus'; we have—bar prematures—a certainty of getting either the one or the other. In other words the chance of getting a 'plus' added to the chance of getting a 'minus' equals unity. If the chance of getting a plus at B (Fig. 1) was ·91, that of getting a 'minus' is ·09; since ·91 + ·09 = 1. This may be clearly seen from Fig. 1 and need not be elaborated; but the result, as might reasonably be expected, is that the 'minus' curve is exactly the same as the 'plus' curve reversed. If we combine the two curves (Fig. 3) it will be seen that the sum of the perpendiculars at any point is 1·00, illustrating the certainty of getting either a 'plus' or a 'minus' at that point.

The 'Plus' and 'Minus' Chances.

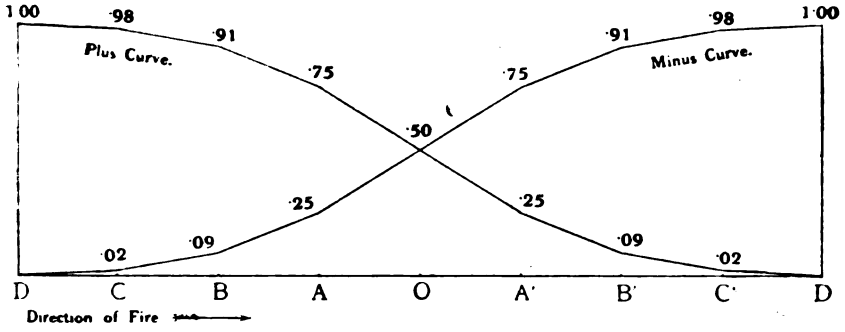

Fig. 3.

We can now approach a point of practical interest; what are the chances of any two rounds giving a 'plus' and a 'minus' of any particular target—say of a target at A? This is merely a 'double' without the bookie's margin. The chance of getting a 'plus' at A (Fig. 3) is ·75; that of a 'minus' is ·25. The chance of getting a 'plus' and a 'minus' in two rounds is therefore ·75 × ·25 = ·19 (in ordinary language 81 to 19, say 4 to 1 against).

In this way it is easy to work out the chance of a pair of rounds giving a 'plus' and a 'minus' of any particular point in the 100% zone. We shall content ourselves with considering only the nine points D to D′ for which Fig. 3 gives us definite values, though any number of other points can be interpolated without difficulty. These results are illustrated in Fig. 4, for which we have for convenience employed a larger vertical scale as the maximum chance (with a target at O) is only ·5 × ·5 = ·25, as against unity in Fig. 3.

Strictly speaking we have now passed the limit of usefulness of rough diagrams, as the angular air of Fig. 4 bears witness; but before taking any drastic and forbidding step on squared paper, let us see, in principle if not in detail, what this ragged diagram can do for us.

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The Combined 'Plus-and-Minus' curve.

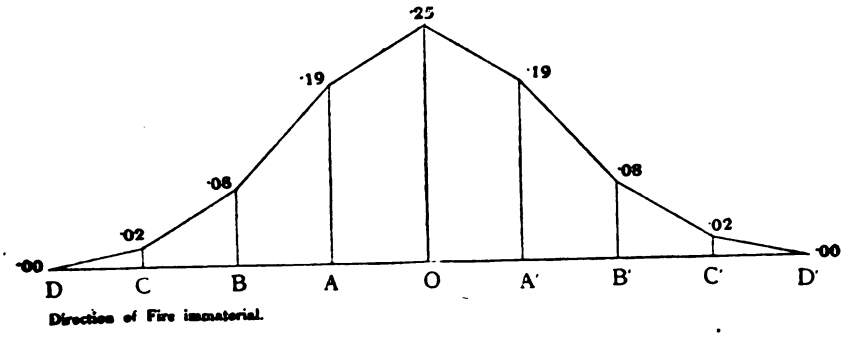

Fig. 4.

On the face of it, it tells us what chance a group of two rounds has of giving a 'plus' and a 'minus' of a target anywhere in the 100% zone, but this is a point of merely academic interest. What we really want to know is; What is the chance that the elevation that gave us a 'plus' and a 'minus' is the correct elevation to the target?

Let us pause and consider. What do we mean by the 'correct' elevation? After all we are ranging, not searching for abstract truth: what we want is an approximation sufficiently close to justify us in going to effective fire, without prejudice to any subsequent modifications that may appear desirable. Let us therefore alter our question slightly and ask: What is the chance that the target on which we have obtained a 'plus' and a 'minus' at the same elevation lies inside the 50% zone of the gun at that elevation?

Let us examine the data at our disposal. Our group of two rounds has given us a 'plus' and a 'minus'; the target must in consequence be somewhere in the 100% zone of the gun at that elevation —unless of course one of the rounds was abnormal, which for the present we will leave out of consideration. Furthermore we know from Fig. 4 the chance of getting a 'plus-and-minus' for any particular position of the target. What can we deduce? Firstly, since the target is somewhere in the 100% zone, and since we have diagramatically divided the 100% zone into 8 equal parts, each part has prima facie an equal claim to it; but secondly, the chances of 'success', i.e. of getting a 'plus-and-minus', far from being equal throughout, vary not only from part to part but from point to point in any particular part.

The chance of the Target lying in any particular part depends therefore on two factors—on two dimensions, and these dimensions, namely the size of the part and the relative chance of 'success' in that part, are reproduced in Fig. 4; the size of the part being the subdivisions of the base, and the chances of success the perpendiculars. In other words, the chance of the target being in any particular part is a measure of the area enclosed by that part, its perpendiculars, and the arc of the curve (diagramatically a straight line) which it

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subtends. This area of course has no finite value, the scale being entirely arbitrary; but going back to our definition of simple odds, we see clearly (let us hope!) that, for example, the chance of the target lying in the part AO (expressed in the form of 'successes' over 'attempts') may be stated as s/S, where s is the area subtended by AO (Fig. 4) and S is the total area of the curve, both expressed in any arbitary units.

Now what we are after is the chance of the target lying inside the 50% zone of the gun at the elevation at which the 'plus-and-minus' was obtained. In Fig. 4 AA′ represents this 50% zone, and the chance of the target lying between A and A′, i.e. inside the 50% zone, is as we have seen:—

$$\frac{\text{the area subtended by A.A}'}{\text{the total area of the curve}} \qquad \left(\text{i.e. } \frac{\text{Successes}}{\text{Attempts.}}\right)$$

(The necessity of reckoning up areas really compels us to use squared paper—but we won't. We will however supplement the results which these rough diagrams give us by those which have been obtained with all the niceties of squared paper and umpteen points; let those who are dissatisfied go and do likewise!)

Let us go back to Fig. 4.

The curve in Fig. 4 is obviously symmetrical about OP; we can therefore express our '50% zone chance' as:—

$$\frac{\text{the area subtended by AO.}}{\text{half the total area of the curve}}$$

i.e. as:—

$$\frac{\text{the area subtended by AO}}{\text{the areas subtended by DC, CB, BA, AO, respectively}}.$$

Considering each of these areas as a rectilinear figure with a unit base, the chance becomes:—

$$\frac{\frac{1}{2}(\cdot25 + \cdot19)}{\frac{1}{2}(\cdot00 + \cdot02) + \frac{1}{2}(\cdot02 + \cdot08) + \frac{1}{2}(\cdot08 + \cdot19) \times \frac{1}{2}(\cdot19 + \cdot25)}$$

$$= \frac{\frac{1}{2}(\cdot44)}{\frac{1}{2}(\cdot02 + \cdot10 + \cdot27 + \cdot44)} = \frac{\cdot44}{\cdot83} = \cdot53 \text{ approximately.}$$

Let us neglect the second place of decimals, and call it ·5, an even-money chance. Working from a really highbrow curve the very similar figure of ·54 was obtained.

What exactly does this mean? That when two rounds fired at the same elevation have given a 'plus' and a 'minus', there is an even-money chance (or slightly better) that the target lies somewhere inside the 50% zone of the gun at that elevation.

So much for the two round group that gives a 'plus' and a 'minus'. The question has been worked out in some detail and perhaps at excessive length, but as all the various problems of brackets are attacked in a similar manner it seemed advisable to follow out the reasoning step by step and, at the risk of prolixity, to eschew short cuts.

Let us now consider the most familiar case of ranging, the

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unverified short bracket; i.e. the case where one round gives a 'plus' and the other, at an elevation reduced by an amount corresponding to twice the 50% zone, gives a 'minus' (the 100 yard bracket, which is merely a convenient approximation to the true short bracket, will be discussed later.)

The Chances of a 'Plus.'

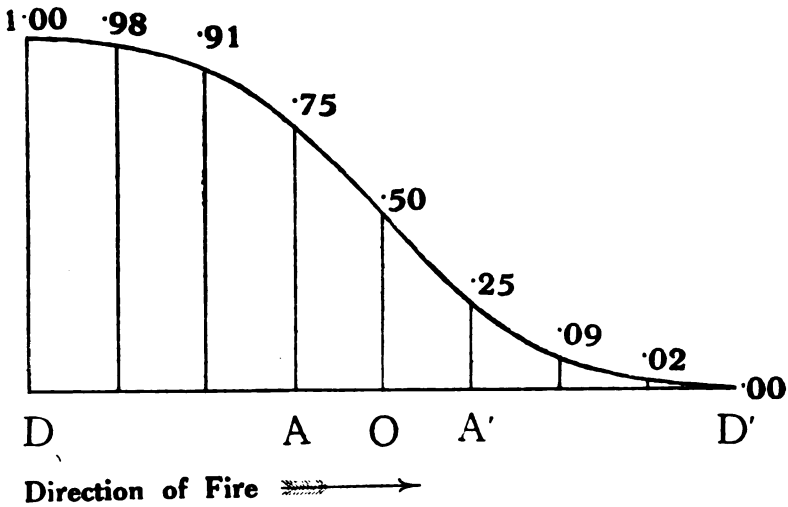

Fig. 5.

We already know all about the chances of a 'plus' (Fig. 2). Let us have another look at them, this time on a reduced scale (Fig. 5). We know also that the Chances of a 'Minus' curve is the same, but reversed. But in this case we are dealing, not with two rounds fired at the same elevation, but with a bracket: hence in this case the 'Minus' curve, in relation to the 'Plus' curve, must not only be reversed but also moved towards the gun (i.e. diagramatically to the left) by an amount equal to twice the 50% zone. But the 50% zone (AA') is one quarter the 100% zone (DD'); the 'Minus' curve must therefore be placed so that its centre is half the 100% zone short (i.e. to the left) of the centre of the 'Plus' curve (O); in other words, the centre of the 'Minus' curve must lie at the point D (Fig. 5). We can now produce Fig. 6.

This combination of the 'primary' ('Plus' and 'Minus') curves is precisely similar to that in Fig. 3, and the method of deducing the 'secondary' Short-Bracket curve is the same as that employed for the 'secondary' 'Plus-and-minus' curve (Fig. 4); namely, for a point lying anywhere in the 100% zone of either elevation (i.e. between Z and D', Fig. 6) the chance of the rounds giving, with the higher elevation a 'plus' and with the lower a 'minus', is the product of the individual chance of each of the two rounds. Let us take one example: suppose the target at D.....Y (Fig. 6). With the higher elevation, the chance of getting a 'plus' is unity; every round must be 'plus' of the short

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The 'Plus' and 'Minus' Curves of the Short Bracket.

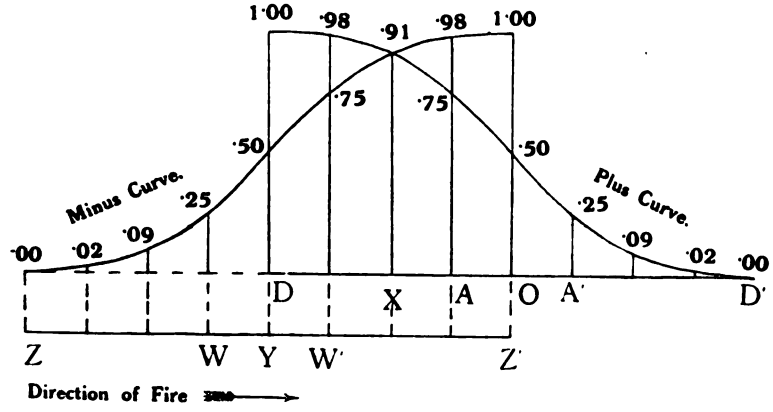

Fig. 6.

end of the 100% zone (and of any point still closer to the gun, e.g. the point W (Fig. 6)—always provided that the gun be well and truly laid). With the lower elevation, the chance of getting a 'minus' at the point D (Fig. 6) is seen to be ·50. The chance of getting a 'plus' and a 'minus' at the respective elevations with the target at D is therefore 1·0 × ·50 = ·50; and so on for as many points as we may care to take.

Working on these lines we arrive at Fig. 7, a diagram of the same type as Fig. 4, except that the reduced scale has emboldened us to draw a curve through the tops of the perpendiculars instead of linking them up by straight lines.

The Unverified Short Bracket.

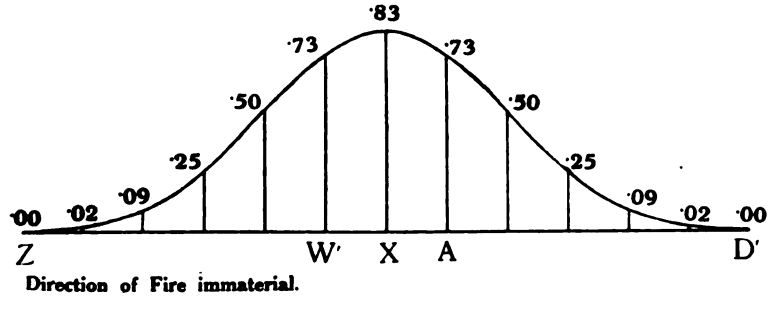

Fig. 7.

What we want the curve to tell us is this: Having obtained a short bracket, what faith may we place in the intermediate elevation? What is the chance of the target lying in our new 50% zone?

Let us return to Fig. 6. The centre of the 100% zone at the

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intermediate elevation is at X, midway between O.....Z and Y.....D, the centres of the 100% zones at the top and bottom ends of the short bracket. Now took at Fig. 7; its base ZD′ is divided into twelve equal parts, each of them being by construction equal to half the 50% zone of the gun. The centre of the 100% zone of the intermediate elevation being at X, what are the chances that the target lies between W′ and A; i.e. inside the 50% zone of the intermediate elevation?

Arguing on the same lines as before, we conclude that they are:—

$$\frac{\text{the area subtended by W′A}}{\text{the area subtended by ZD}}$$

i.e.

$$\frac{\text{the area subtended by W′X}}{\text{the area subtended by ZX}}$$

which Fig. 7 shows to be $\frac{\cdot 78}{1\cdot 99}$ or ·39, say ·4; the answer given by a more accurate curve being ·395.

In other words the intermediate elevation of an unverified short bracket has considerably less than an even-money chance of including the target in its 50% zone. What about verifying it?

This is a perfectly simple problem. A verified short bracket is after all only two short brackets. It is the old question of Cuthbert and myself dying on a Monday. If the chance of getting a short bracket on any particular target is say ·73 (e.g. the point A, Fig. 7), the chance of getting two short brackets is ·73 × ·73, or $(\cdot 73)^2$; in other words we can compile a verified short bracket curve from Fig. 7 by the simple process of squaring the perpendiculars. Here it is (Fig. 8).

The Verified Short Bracket.

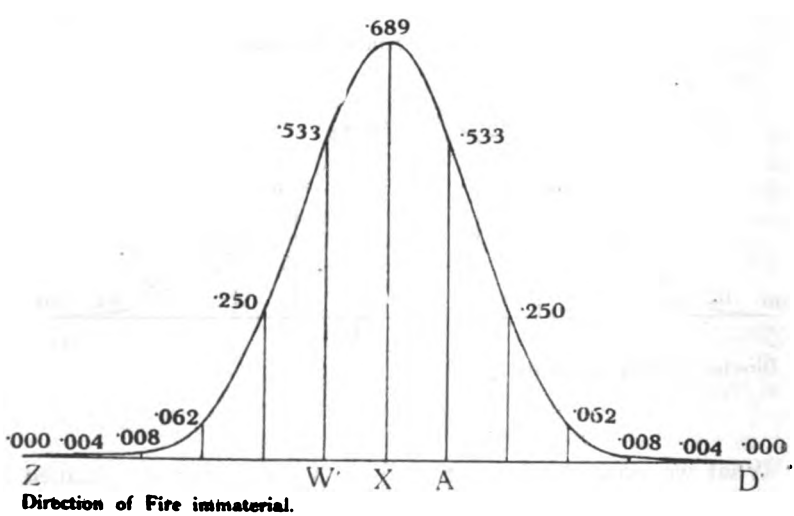

Fig. 8.

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The chance of the target lying in the 50% zone of the intermediate elevation is worked out as before, and comes to slightly better than even-money; ·52, to be precise. Those who are sufficiently interested can work it out for themselves—a pleasant exercise in what the pundits call Inverse Probability, though, as we have seen, it boils down to simple arithmetic.

We have now examined the two most familiar phenomena of Ranging, one might almost say its two standard forms; the 'Plus-and-Minus' at the same elevation and the Verified Short Bracket. We have seen that their reliability is approximately the same, that in both cases there is slightly more than an even-money chance that the 50% zone of the gun at the appropriate elevation will embrace the target; a theoretical result that appears to be confirmed by practical experience. These twin factors, the 50% zone and the even-money chance, are the standard against which we will test all other varieties of bracket and group, the standard which we will bear in mind when we attempt to reply to a question which is often asked and seldom answered: Why use a short bracket corresponding to twice the 50% zone of the gun?

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PRÉCIS OF REVUE MILITAIRE SUISSE.

March, 1920.

By Brig.-Genl. H. A. Bethell, C.M.G., late R.A.

The Genesis of the Battle of the Marne.

Much criticism is still directed at the strategy of the French High Command in 1914. But the critics are too apt to base their remarks on what actually happened, instead of what might have happened.

It is objected that the French concentration did not block an invasion from Belgium. But if the invasion had been through Switzerland, or by way of Verdun or the Moselle, a concentration on the Belgian frontier would have been fatal. The very fact, that the Germans hardly troubled to conceal their designs on Belgium was enough to justify the suspicion of a snare. The French 4th Army, intended to form a strategical reserve, had to be put into the line at once. But the Germans, as well, put the whole of their force into the line.

Marshal Foch's recent remarks throw a light on the French strategy. "After a long-continued policy of peace and pure defence, it is difficult for an army to begin by taking the offensive. The only armies capable of this Napoleonic method are those of Imperial powers, greedy for conquest, and aggressive in their policy."

The French offensive in Alsace seems indefensible, but this was the work of politicians, not of soldiers. The childish order, before the beginning of hostilities, to withdraw all French troops ten kilometres from the frontier, was certainly not conceived by the military.

The French offensive between the Vosges and the Moselle was a failure. That of the Ardennes broke down through errors in execution. But the idea of catching the Germans in flank during their advance into Belgium is fully justifiable.

General Le Gros has written a book finding fault with Joffre and praising Gallieni, to whom he gives all the credit for the battle of the Marne. He makes it appear that Gallieni alone conceived the idea of turning on the Germans. The Swiss critic is unable to accept this view. The operation had already been planned by Joffre 15 days beforehand; but no one could tell when the favourable moment would arrive. On the 3rd, Gallieni received the aviation reports that the German columns were inclining to the S.E. He at once reported to G.H.Q., recommending that the 6th Army be moved to the E. by the North bank of the Marne. On the 4th he verified these reports, and at 9 a.m., on his own initiative, ordered the 6th Army to prepare to move. He telephoned to G.H.Q. urging

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that the retreat be stopped, and found Joffre so fully in agreement with him that when he got the historical order of the 4th (which was issued at 6 p.m. and reached him at midnight) it completely confirmed his own order, issued at 10.30 p.m. Gallieni deserves full credit for his initiative, but he was only carrying out Joffre's plan.

General Le Gros' book is well worth study, even though we may not agree with all of his conclusions.

Engineer troops in the World War.

In previous wars the engineers have had little opportunity of showing what they could do, but in this, a stationary war, their work was of immense importance. They built defences, dug-outs, quarters, railways and even harbours. In the American Army one soldier in nine was an engineer.

Ludendorff.

Judging him by his book, he has great power of calculation, but little imagination; he knows the German soldier, but he does not know men; he is learned in strategy, but lacks the touch of genius required to apply his knowledge. His best work was done against Russia, though he was hampered by inefficient allies. His brutal strategy in March 1918 contrasts poorly with the skilful work of Foch, who multiplied his attacks till the German reserve was reduced from 80 divisions to 15, and then broke through on the Lorraine front.

Military Notes.

The new Swiss Minister for War, M. Scheurer, has already proved himself a strong man.—The Treasury insist on cutting down the Swiss army from 25,000 to 19,000 men.—The French soldier still serves 3 years; the period is to be reduced to one year as soon as the German disarmament has been satisfactorily completed.—The French Territorial troops were middle-aged married men, and seemed hopelessly bad at first. But they soon smartened up, and did very well in the Alsace offensive in 1914.

Book Reviews.

"The Mistake of the French High Command." By General Percin.

The author is more concerned to decry other people than to give good reason for his criticisms. A partisan book.

"The Nation in Arms," by Viri.

This is the pseudonym of a group of French officers, and sets forth their views as to the necessity for reform, the new organization of the army, and the new system of training. They consider that a recruit can be trained in three months, but recommend a period of service of 15 months till things have settled down in Germany and elsewhere.

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PRECIS OF REVUE D'ARTILLERIE.

March, 1920.

Contents.

Le Colonel de Bange. Died July 1914. Owing to the storm brewing in Europe his death did not make that impression on his companions in arms, it would have if it had occurred a few weeks earlier. The "Revue d'Artillerie" feels it to be its duty to remind its readers how largely the material created by Col. de Bange helped in the Victory. Over 5000 of his coast guns, some 40 years old were used during the war.

All British gunners know the name well in connection with the de Bange Obturator.

The American Artillery in France—by Col. A. Maitre, Chapter II. gives composition in time of Peace and tells us how in 1917 Gen. Pershing ordered it to be trained and organised on French lines. Deals with training of officers and units—equipment and horses and organisation of command.

The Stereoscopic Range Finder.

German opinion on Heavy Artillery and its Allocation to Divisions. From two articles by Gen. von Richter, and Gen. Rohne written in Nov.—Dec. 1917.

Description and photographs of the Christie Automobile carriage for 155 gun. (U.S.A.)

Electric Pen to write on Steel. (U.S.A.)

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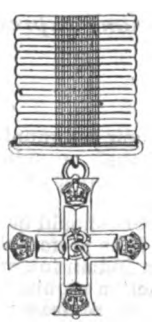

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MOBILE ARTILLERY AND AIRCRAFT.

A Special Prize was recently offered in the Journal by a Field Artillery Officer, for the best article on the above subject, the winner being:—

CAPT. H. R. KILNER, M.C., R.G.A.

THE introduction of the aeroplane into modern warfare has created a minor revolution in the tactics of almost every branch of the services. The Artillery, in common with the rest, has been compelled to formulate new ideas and to re-arrange old ones, in order to conform to this new factor; and in addition has been confronted with entirely new problems, the solutions of which present a formidable array of difficulties.

The object of this essay is to discuss some of these problems, and to suggest lines along which a solution may be sought; but the discussion must be of the briefest nature owing to the limited space available.

The actual problems it is proposed to deal with are:—

(a) Co-operation between Field Batteries and our own Aircraft.

(b) Protection and Concealment from Enemy Aircraft.

(c) Artillery attack of Enemy Aircraft.

(a) CO-OPERATION BETWEEN FIELD BATTERIES AND OUR OWN AIRCRAFT.

In past warfare the Artillery have relied chiefly on the forward observing officer for their information and observation.

Co-operation with Aircraft has been attempted and advanced to a certain extent, but chiefly owing to the difficulties of communication and the employment of observers having no great knowledge of artillery limitations and difficulties, the success attained has been only partial.

For many obvious reasons a forward observing officer is unable to locate distant targets with any degree of accuracy, nor is he able to direct fire on them with certainty even should their exact location be known.

At best, there are many parts of the hostile country which are invisible to him, where the enemy can place their artillery under total concealment. Under these conditions a forward observing officer is rendered inoperative, being unable not only to locate or bring fire to bear on the hostile battery, but even to report its activity.

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The difficulties he is presented with are of a nature not likely to be overcome by any normal advance in scientific knowledge, and therefore, if there is to be an improvement in the control and observation of indirect artillery fire, such improvement must be looked for as a result of better aerial observation.

An observer in an aeroplane clearly possesses many unique advantages over his brother on the ground. He enjoys an uninterrupted view of the whole of the enemy's battle zone, and is probably less harassed by the enemy's artillery fire than he would be were he situated in some exposed observation post on the ground. His position enables him not only to pick out any hostile batteries that may be active, but also to locate them accurately with regard to the surrounding country and to identify their position on the map with exactitude.

As regards the ranging of his own battery on to a target, he is again more advantageously placed than the ground observer; for, instead of being limited to an observation as to whether the round has fallen beyond or short of the target, he can form an estimation as to the amount it is out for range.

It will probably never be advisable to dispense with the present system of bracketing for range, but there can be no doubt that, with a skilful observer, the time occupied can be considerably curtailed.

If, then, it be admitted that by virtue of his position, the aeroplane observer is more fitted than the forward observing officer both for the purpose of supplying information and of observing fire, let us consider what factors are necessary to ensure success; and what were the reasons for the only partial success achieved in the past.

The first question to arise is that of communication between the battery and the aeroplane. Up to the present there has been no means of communicating from the battery to the aeroplane, and the reverse procedure has been but inadequately carried out.

The introduction of the first, and the improvement of the second form the essential foundation upon which any improvement must be built; as, until efficient communication exists, no mutual confidence between observer and battery can be established.

Advance in scientific knowledge is tending to overcome this difficulty by the introduction of a wireless receiving apparatus on the aeroplane, and the advent of wireless telephony. It is to be hoped that, as the latter becomes perfected, communication between battery and observer will become almost as easy as communication between battery and forward observing officer has been in the past; with the additional advantage of there being no wires to be broken by hostile shelling.

Wireless telephony can be tuned to cut out all communications not transmitted in a given key, and by this means it may be possible to reduce the number of observations audible to a certain battery to not more than two or three; and from these it should not be difficult to select the particular observation that applies to that battery.

It must be remembered that, in wireless telephony, the speed of transmission is very much greater than in ordinary wireless, and in consequence of this it will be easier to indicate the battery to which the observation refers.

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In the future, therefore, if wireless telephony can be perfected, and the instrument made sufficiently light and portable to be carried by an aeroplane, this method of communication would undoubtedly be the best to employ.

At the present moment, however, wireless telephony has not reached a sufficiently advanced stage to allow of this, and in consequence ordinary wireless transmission is the best that can be employed. It is possible for the aeroplane to carry a receiving as well as a transmitting apparatus, and with this improvement there is no doubt that much of the misunderstanding and confusion of the past will be overcome.

Communication in itself is not sufficient to create confidence between battery and observer. Personal acquaintance is also necessary, and this is a factor which has been too frequently overlooked in the past. The feeling has been that although the observer may have been doing his best, he was probably an ex-cavalry or ex-infantry officer, and that therefore his knowledge of artillery matters was distinctly limited.

In many cases this was true, as the available supply of artillery officers was insufficient to provide observers for aerial work; but in the future it is to be hoped that this will be overcome, and that all observers will be fully trained in artillery matters, and will be in the closest touch with the batteries for which they are to observe.

If this can be accomplished, and a spirit of mutual confidence can be engendered, observation by aeroplane will be made a success, but until such a state of affairs is realised it must be doomed to failure.

Another point where room for improvement in co-operation became apparent, was the delay which occurred in the transmission of intelligence from the aeroplane to the battery; and there are occasions when the whole value of such intelligence depends upon its immediate transmission, and this is especially so in mobile warfare.

In trench warfare, the majority of this information is not required in any very great hurry, and therefore it can be transmitted in the normal manner through the higher commands; but in mobile warfare it becomes essential that this information should reach the batteries with as little delay as possible, and to ensure this, it should certainly be transmitted direct to the Brigade H.Q. by the aeroplane, or, better still, direct to the battery.

It would probably be left to the discretion of the observers as to whether the importance of the information they obtained was such as to justify their transmitting it direct to one of the batteries instead of to the Brigade H.Q.; and for this reason they would require a knowledge of artillery methods, and a faculty for rapid appreciation of a situation. An organisation which will permit of information being transmitted direct in this manner, without causing confusion, is an extremely difficult one to devise, and is unlikely ever to be successful unless the number of aeroplanes allotted to work solely with the artillery is considerably in excess of the number which has been allotted in the past.

Probably the only satisfactory method would be to affiliate, to each artillery brigade, a definite number of aeroplanes, whose duty it would be to supply information to that brigade alone.

Naturally the information so obtained by the brigade would be

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passed, not only to its own batteries, but also back to the higher commands, and to any other brigades which might be in touch with it.

The pilots and observers of aeroplanes so allotted, would work continuously with the same brigade in order that the personal factor might be introduced to the greatest possible extent, and to enable the brigade commander to appreciate the reliability of the individual officers observing for him. The observers should also be brought into close personal acquaintance with the officers of the batteries to produce mutual confidence.

The artillery has not as yet learnt to rely on the aerial observer to the extent that it must eventually be compelled to do, and in the opinion of the present writer, this can only be effected by an advancement along the lines indicated; namely, by ensuring personal acquaintance between the observer and the battery personnel, by selecting observers of high capabilities and subjecting them to specialised training, and by increasing the number of aeroplanes allotted to artillery duties and affiliating definite observers to each brigade. It is by improvement in these directions that the most rapid progress will be made, but it cannot be too strongly emphasised that the most essential of these is the establishment of the requisite intimacy between battery and observer, without which effective co-operation must always be impossible.

(b) PROTECTION AND CONCEALMENT FROM ENEMY AIRCRAFT.

Although the introduction of the aeroplane as a means of observation had been anticipated before the last war, the extent of concealment necessary for artillery, as a result of its advent, was not sufficiently realised. During the opening stages of the war, the mobility of the conflict and the short time the positions were occupied, prevented any great ingenuity being exercised in this direction; but when resort was made to trench warfare and the opposing lines of infantry were more or less stationary, the positions for artillery batteries became limited, and in consequence were occupied for long periods. Under these conditions it became a matter of necessity to conceal them from the observation of hostile aircraft by every possible device.

The amount of work and thought expended on this matter varied considerably in different batteries, but the results went to prove that those units which had taken the most trouble to obtain effective concealment were well repaid for their labour.

It is proposed to discuss briefly the various means which can be employed, to conceal an artillery unit from aerial observation.

On the Line of March.

Movements of troops in the forward area almost invariably take place by road, and it is well known that the white ribbon of road forms one of the most conspicuous features in a landscape, when viewed from an aeroplane. Troops moving along a road will always be visible to an aeroplane, and to conceal them under these conditions is impossible, and must be accepted as such. The only way to avoid discovery is, where possible, for the troops to leave the road imme-

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diately a hostile aeroplane appears, and to conceal themselves in any ditches, hedges, or trees, which may border it. It is almost superfluous to add that they should on no account turn their faces upwards as this means instant betrayal.

Guns, and other vehicles which are unable to quit the road at a moment's notice, can only hope to disguise what they really are, and for this reason it is advisable to camouflage them in such a way as to conceal their true nature from the enemy.

Effective concealment of guns, when on the move, can often be accomplished by stretching a sheet of camouflage wire netting over them, or by covering the piece itself with some light coloured material, the projecting muzzle being the greatest "tell tale" of a limbered gun.

In view of the difficulties of concealment; troops, and especially guns and transport, should, whenever possible, be moved at night or during dull weather when hostile flying is improbable.

In Position.

The concealment of battery positions and wagon lines can be divided into three parts, namely: natural concealment, or the selection of naturally concealed positions, artificial concealment, and avoidance of betraying factors.

The question of the selection of a position which will provide the maximum of concealment is dealt with at great length in the training manuals, and as nothing of value can be added thereto, no further discussion on this will be made.

The question of artificial concealment has been a matter of much discussion in the past. The problem is an extremely interesting one, offering great scope for imagination and attention to detail, and resolving itself into a trial of wits between the battery and the hostile observer.

It is impossible to lay down any hard and fast law as to the methods to be adopted, as each position must be considered on its own merits. It is of great assistance to view the position from an aeroplane, when any features which indicate the presence of guns or give the position away, should be noted for obliteration. When observation from an aeroplane is not possible, a great deal of help can be obtained by carrying out an inspection from any commanding position in the neighbourhood, preferably from the direction of the enemy.

The first and most common method of attempting concealment is by camouflage painting of the guns. This must be done with discrimination, as the whole object of this is to break the outline and confuse the shape, and therefore the boundaries of the different patches must be arranged with the greatest care. If this is not done the last state may very easily be worse than the first, examples of this having been only too common in the past.

The colours of the patches should be selected to blend with surrounding objects; and in order to ensure this it may be necessary to repaint after each change of position.

Camouflage wire-netting can be employed with advantage, but when living greenery is used, it must be renewed at frequent intervals,

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otherwise the change of colour due to fading may form an indication rather than a concealment.

Much can be done in the way of dummy guns to divert attention elsewhere, and it must be borne in mind that the ultimate object in concealing the position is to avoid hostile shelling, and therefore any steps which may help to disguise its nature or confuse its exact location should invariably be taken. Effective concealment can only be obtained by close consideration and a great deal of trouble.

Many cleverly concealed positions have been given away by minor details, which, while escaping the notice of the battery personnel, have nevertheless been clearly visible to the observer and have formed the means of betrayal. It is for this reason that emphasis has been laid on the advisability of viewing the position from the air whenever possible.

Examples of such details are footpaths, smoke from fires, glittering objects, and so forth; and they can only be avoided if every member of the battery gives the matter his continual attention.

The prevention of these often necessitates the imposition of irritating restrictions, the importance of which is not realised by the men unless the necessity for them be explained. Such explanation should always be made, since it is only by the willing co-operation of all concerned that the desired result can be obtained.

During the last war, camouflage schools were instituted and a visit to them was a revelation as to what can really be done in the way of concealment. It is to be hoped that, in the future, all officers and non-commissioned officers will be given a certain amount of instruction as to the best methods to adopt.

Effective concealment grows more difficult as aerial photography improves, and would become almost impossible were it not that the observing aeroplane is forced to fly at increasing heights as anti-aircraft fire becomes more accurate.

The present generation of gunners has learnt, by bitter experience, the importance of concealing positions from observation, and it is to be hoped that future generations will remember the lesson so learnt, and not renew the past errors of mis-placed gallantry.

(c) ARTILLERY ATTACK OF ENEMY AIRCRAFT.

In the ensuing discussion of this section, it is proposed to consider it from two points of view:—

(a) Nature of guns required, and their tactical employment.

(b) The gunnery problem requiring solution.

The peculiar difficulties encountered when engaging aerial targets with artillery fire, render it imperative that the attack of enemy aircraft should be relegated to a particular branch of the artillery, equipped with special guns and instruments, and particularly trained in this type of gunnery. Only in exceptional cases will the Artillery of the Field be in a position to engage aircraft, a consideration of which cases will be made later.

The Anti-Aircraft Artillery will be required to fulfil the following functions:—

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(a) Provide a screen with the advanced line of infantry or advanced guard, to prevent hostile aircraft from reconnoitring the forward area, or disposition of the forward troops.

(b) Protect the main body from hostile observation, especially with regard to gun positions, concentration centres, and movement of troops.

(c) Defend vulnerable points against hostile bombing attacks.

To fulfil these duties in an adequate manner, at least two types of anti-aircraft guns will probably be necessary; as their essential requirements will differ according to the nature of the duties they are called upon to perform.

It is clear that guns required to move with the advanced troops will need mobility as a first essential, and this in turn necessitates lightness of construction.

It has not at present been found possible to construct a gun and mounting sufficiently light as to be thoroughly mobile, without sacrificing something of range and accuracy; and as these guns will be required to traverse country which is barely passable to light horse-drawn vehicles, this sacrifice must be made.

Those guns, on the contrary, which are not required for such advanced duties, have not the same need of mobility, as their position will be considerably further in rear; where, presumably, transport conditions will be fairly good. In their case the chief factor in construction will be maximum range and accuracy, and mobility only in so far as it can be made compatible with this. It may be mentioned here that the light tank forms a probable solution to the combination of weight and mobility, and if this be adopted, it may be possible to obtain a high standard of range and accuracy even with the most forward guns. At the same time two types of mounting would still be necessary, as it would be uneconomical to employ A.A. guns on tanks for the defence of vulnerable points far in rear.

In general, therefore, it may be assumed that at least two types of gun or mounting, or probably both, will be employed; and for the same reasons the equipment of instruments and methods of shooting will vary under the different conditions. For, whereas it will be possible to employ heavy and cumbersome instruments with the guns in rear, requiring considerable time to set up, and possibly an elaborate telephonic installation, such instruments will be quite impossible for employment with the forward guns, which will be forced to rely on a few light and portable instruments, which can be rapidly set up and dismounted.

The tactical employment of these different types will depend, almost entirely, on the nature of the country and the attitude of the enemy. During the advance, the position of the more mobile guns will be with the advanced guard and as near to the cavalry screen as possible, their duties being comparable, with those of the R.H.A. They must of necessity be pushed as far forward as possible, in order to compel hostile aircraft to attain a considerable height before attempting to reconnoitre the position of the troops in rear.

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A few of the more mobile guns may also be employed with the head of the main body, as the heavier types will be necessarily relegated to the rear, owing to their liability to block the roads and impede the advance. The extent to which the heavier types will be brought forward in open warfare will entirely depend upon tactical considerations. As a general policy it may be taken that, when an advance is impending, the anti-aircraft guns should be pushed as far forward as possible, in order to provide the necessary protection for advanced dumps of ammunition and supplies, whereas, when a retreat is contemplated, they should be withdrawn at an early stage and employed in covering the withdrawal, in cases of emergency they may also be employed against land targets, their all-round traversing gear making them particularly useful for engaging tanks.

In trench warfare, the heavier types will move forward and take up positions close to the line, wherever the nature of the country offers sufficient concealment, and means of communication are available. On many parts of the front the bare nature of the country and the activity of the enemy will render their employment inadvisable, when resort will have to be made to the lighter types, whose mobility will enable them to avoid hostile fire whilst maintaining the defensive screen. During the past war, the scarcity of A.A. guns has necessitated their employment on a somewhat meagre scale. The tactical unit has normally been a section of two guns, but experience has shown that more satisfactory results are obtained by concentrating a larger number of guns under a single control.

The future formation will therefore probably be not less than four guns in the tactical unit, though this again must largely depend upon local conditions of cover and hostile activity.

There can be no doubt that in defending a vulnerable point, the policy of massing guns will always be the more likely to lead to success, but at the same time, where the civil population is in evidence, their feelings must be considered to a certain extent, and to them the proximity of an anti-aircraft gun gives a sense of security.

It was this consideration that led, in the past, to the dispersal of single gun stations over a wide area. As has already been pointed out, the attack of enemy aircraft must normally rest with the anti-aircraft artillery. At the same time it should be borne in mind that occasions do arise when the Artillery of the Field may offer material assistance. This particularly applies to the lighter type of howitzers.

The low-flying, patrolling aeroplane, possibly engaged in ranging a hostile battery, offers an example of such an occasion. This type of target will frequently pass and re-pass a given point during its patrol and therefore can be engaged by any light howitzer equipped with time-fuzed ammunition, but owing to the limitation of the traversing gears on such guns, continual following of the aeroplane is rendered impossible.

The best procedure, therefore, is to lay the gun on a point which it is anticipated the target will cross, and attempt to fire it at such a moment that the arrival of the shell and target will synchronise at the selected point.

To allow for discrepancies it is as well to fire a burst of three or four rounds, or to fire three or four guns in succession.

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It is not possible to lay down any hard and fast rules as to the method of employing anti-aircraft artillery, until more information as to the future policy of equipment is forthcoming. The above points, therefore, are only meant to indicate the general lines on which the matter should be approached.

THE GUNNERY PROBLEM.

During the past war, anti-aircraft artillery, in common with other branches of the regiment, was placed at a great disadvantage by insufficient training of personnel; and this was all the more serious in view of the high standard which is required by this particular branch.

But even more detrimental than lack of training was the lack of adequate equipment.

During the whole of the war, only two instruments peculiar to A.A. work were universally issued, and moreover the gun and mounting employed were, throughout, the same temporary design originally made up in 1914, with a few minor alterations.

It may therefore be hoped that, in the near future, great strides will be made in improving the accuracy of anti-aircraft fire, not as a result of any advance in theory, but by the practical application of present theory to future construction.

In considering the problem of bringing artillery fire to bear on aerial targets, it will be advisable to follow the usual procedure and divide the problem into three parts, namely:—

(a) Determination of the "present position"; i.e., the position of the target at the moment the gun is fired.

(b) Determination of the "future position"; i.e., the position of the target at the moment the shell bursts.

(c) Causing the trajectory to pass through the "future position," and the shell to burst at that point.

It is proposed to discuss each of these divisions in turn, especially with regard to the lines along which improvement may be looked for in the future.

DETERMINATION OF THE "PRESENT POSITION."

The means of determining the "present position" of the target lie in selecting, from a quantity of available data, the most suitable factors to employ. The desiderata to be borne in mind when making the selection are ease of measurement, and comparative constancy.

These available data, from which selection is to be made, consist of Range, Height, Angle of Sight, and Horizontal Range (by which is meant the distance between the gun and the point on the same level immediately below the target), and it is necessary to consider the advantages and disadvantages of each of these in detail.

Range.—This varies very rapidly and not at a constant rate. Instruments are available for measuring the range to a target, but none of them will measure the range of a rapidly moving target with any reasonable degree of accuracy.

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Height.—This may be assumed to remain fairly constant for short periods of time. It is almost as difficult to measure as range, and, in fact, before the introduction of special height-finding instruments for A.A. use, could only be found by first measuring the range, and then converting this to height by co-ordination with the angle of sight.

Angle of Sight.—This varies very rapidly and not at a constant rate. It is, however, extremely easy to measure accurately.

Horizontal Range.—This varies continuously, but from a knowledge of the speed and the direction of travel of the target, the amount of change can easily be predicted. It cannot be easily measured unless the range or height of the target be known.

From these data it is necessary to select any two factors, which, in combination with the bearing, are sufficient to determine the present position of the target.

Angle of sight is the only one of these four which can be easily and accurately measured, and is therefore one of the most suitable to be chosen. The selection of the second factor presents more difficulty.

In 1915, when anti-aircraft gunnery began for the first time to be seriously considered, the second factor selected for determination of the "present position" was height.

This selection was made in view of the fact that A.A. guns were already equipped with an instrument designed to read the range of the target; namely, a 1-metre Barr and Stroud range-finder, and height could be rapidly deduced by combining this range with the angle of sight already measured. Height was selected in preference to range, as it was thought, at that time, that the height of any target might be assumed to remain constant over reasonable periods of time; whereas the range must be continually altering.

This decision still holds good; advancement having been sought for by improving the methods of determining height. The original 1-metre Barr and Stroud range-finder was peculiarly unsuited for measuring the range of an aeroplane, owing to the difficulty of obtaining accurate coincidence on a fast moving target. Other instruments measuring height were devised later in the war, but these were of a long-base pattern, and presented difficulties when worked in conjunction with forward gun positions, owing to their lack of portability and the necessity for telephonic communication between the ends of the base.

The height of the target was therefore seldom found with any degree of accuracy, and, in consequence, the primary requisite for the solution of the A.A. problem, namely, the fixing of the "present position," remained undetermined.

Since the cessation of hostilities, an instrument has been approved, which combines portability with accuracy, and in the future, therefore, it should be possible to fix the present position of the target with a reasonable degree of success.

Although the usual method of determining the "present position" has been to employ height in conjunction with angle of sight, considerable investigations have been made utilising other combinations of the available factors; very commonly angle of sight and horizontal range, or height and horizontal range. These methods have no

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advantage over that already discussed for the determination of the "present position," but, as will be seen later, offer different lines on which to approach the further solution of the problem. Such instruments as have been designed on this basis have not as yet proved successful, but the results are sufficiently encouraging to warrant further investigation.

DETERMINATION OF THE "FUTURE POSITION."

The "future position" of the target will clearly depend upon the "present position" and the travel of the target during the time of flight of the shell.

In order to fix it, it becomes necessary to measure by some means what the change in the position of the target will be during the time of flight. It is this measurement which forms the most difficult problem that the anti-aircraft gunner is called upon to solve, and it may almost be stated that no satisfactory solution has as yet been arrived at.

As a basis on which to work, it is essential to make some assumption as to the course of the target during the time of flight; otherwise if it be allowed that the target may fly in any direction, it becomes impossible to bring aimed fire to bear upon it, and the number of rounds required to effectively barrage all possible "future positions" is altogether prohibitive.

Some assumption must therefore be made, and the first and most obvious one is to assume that the target will continue to fly at a constant speed and in the direction in which it is already travelling, during the time of flight.

If the target does not conform to this assumption, then the anti-aircraft gunner must be prepared to miss, and to miss by a large amount.

The second assumption made is that, under normal circumstances, the target will remain at an approximately constant height during the time of flight.

This is not of such vital importance as the first assumption, since it is quite possible to compete with the target which is changing height, though naturally the difficulties of directing fire against it are increased.

If we assume that the height of the target will remain constant, the "future position" will differ from the "present position" in two factors, namely, bearing and angle of sight; and the problem resolves itself into the prediction of the change that will take place in these factors, for a target flying on a fixed straight-line course during a certain time of flight.

Three methods of solving this problem have been employed, they are:—

(a) The Tachymetric method.

(b) The Goniographic method.

(c) The Plan Predicter method.

The first of these, the Tachymetric method, has been adopted up to the present by the British. It consists of measuring the angular velocities of the target at the present position, both vertically and

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horizontally, and thence, by a multiplication of these with the time of flight of the shell, deducing the actual change in angle of sight and bearing that will occur.

The results so arrived at are obviously not strictly accurate, as they would only be so were the angular velocities constant during the time of flight; whereas it has been assumed that the target will fly in a straight line during this period, and therefore the angular velocities cannot remain constant.

The errors so produced, although small, are not negligible; and an adoption of the tachymetric method necessitates a subsequent correction for these errors on the gun sights themselves. Further, no really satisfactory instrument to perform the functions outlined above has as yet been evolved. The only one which produces the required results is the Brocq Predicter. This is a highly complicated and very delicate electrical instrument totally unsuited to withstand the rough usage of active service. It requires a very high standard of training in its operators, and a considerable knowledge of electricity to keep it in adjustment. Therefore, although the tachymetric method has been adopted into the service for lack of a better, it is improbable that it will eventually prove the best method to employ.

The second method, or Goniographic method, at one time enjoyed a certain amount of popularity with the French Anti-aircraft Artillery.

If the speed of a target and its direction of travel relative to the gun be known, it is possible to construct an instrument which having been set to these data and the height of the target, will read off the requisite change in angle of sight and bearing, for the times of flight of the various fuze settings. The difficulty with this method, is to determine the initial data, namely, speed and direction of travel.

Instruments have been devised which record the direction of travel of the target, but the measurement of speed is far more difficult. No method necessitating the measurement of the time of travel over a fixed distance, or similar procedure, can be of any value; as too much delay would thereby be entailed, and the opportunities offered to anti-aircraft gunners are fleeting, and can admit of no delay.

Estimation of speed is also impossible, as although the air-speed of a particular type of target may be known, it is the ground speed that is required, and this will depend upon the direction and velocity of the wind at the height of the target, which in turn cannot be deduced from the wind prevailing on the ground.

Therefore, although the goneographic method appears attractive, and is more satisfactory than the tachymetric method, in that it produces a correct result, yet it requires data which are not at present available.

The Plan Predicter method has only comparatively recently been investigated and experimented upon, and although no very startling results have been obtained up to the present, yet sufficient promise has been shown to warrant further careful consideration.

In general, the method is to locate the present ground position of the target; that is to say, the "present position" of the target is determined by the measurement of bearing, horizontal range, and angle of sight. By observation of the movement of the ground position of the target, the speed and direction of travel are deduced.

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From this and the time of flight, the future ground position of the target is predicted, and from that the future horizontal range is read off.

This method, in common with the goneographic method suffers from the difficulty of determining speed without any delay; but, by actual plotting of the ground position, methods of determining speed are available if developed which are not available in the case of the goneographic method.

A consideration of these three methods forces the conclusion that no satisfactory result has as yet been arrived at, and that the problem of predicting the "future position" from the "present position" remains unsolved. Of the three, the last appears to offer most promise, but success is still a long way off.

Even when a solution has been obtained, whether by one of the three methods outlined above, or by some as yet undiscovered method, the difficulty is by no means overcome.

The more accurate anti-aircraft fire becomes, the closer study will the pilot give the means of avoiding it. He will discover that it is directed on the assumption that the aeroplane will fly in a straight line and at an approximately constant height, and he will take steps to ensure that these assumptions are not fulfilled. Were a pilot to exercise real ingenuity in turning, varying his speed, and altering his height, without it being apparent from the ground, he could prevent effective fire being brought to bear on him, if it were directed by the methods at present in use.

The anti-aircraft gunner therefore finds himself in this unpleasant predicament, namely that, as he solves the problems at present confronting him, he creates for himself other and more difficult problems in the future.

CAUSING THE TRAJECTORY TO PASS THROUGH "FUTURE POSITION," AND THE SHELL TO BURST AT THAT POINT.

In turning to the third part of the problem, it may be noted in passing that the two previous portions have been in reality purely geometrical problems. This part, on the contrary, is a distinct gunnery problem.

Dealing with the second requirement first, namely the selection of a fuze-setting that will cause the shell to burst at the requisite point on its trajectory. An instrument has been devised which accomplishes this automatically, providing it be continually layed on the target, and is adjusted according to the height of the target, and the difference in angle of sight between the present and future positions (known as the vertical deflection). This instrument is called a Height Fuze Indicator, usually abbreviated to H.F.I. It consists of a chart representing a vertical section through the gun, and on this chart are engraved curves showing the point at which each whole fuze-setting will burst, when fired at any Q.E. from 0° to 90°. By keeping the instrument continually layed on the target and having set it as directed above, the "future position" of the target is continually indicated on the chart; and by an inspection

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of this position relative to the fuze-curves, the most suitable fuze-setting can readily be seen.

It should be noted that the instrument is not set to the exact vertical deflection, but to a slightly greater angle; this being due to the fact that a certain period of time must elapse between the reading of the instrument and the firing of the gun (which is the moment of "present position"). During this period, the target will have travelled some distance, and the amount so travelled must be allowed for in selecting the fuze.

The objection may be raised that it is impossible to determine the vertical deflection until the time of flight be known, and this will not be known until the fuze-setting is read from the H.F.I.; which therefore cannot be set to the vertical deflection.

This is theoretically true, but in practise it is found that if a reasonable estimation of the time of flight be made, one subsequent readjustment will usually be sufficient to absorb any errors.

Fractions of a fuze-setting are not employed in anti-aircraft firing. The reason being that no attempt is made to obtain a hit with a particular round, but rather to fire a series of rounds with the same fuze-setting, and thereby produce a zone of fire, which it is hoped will absorb any errors that may have crept in. The accuracy of the present equipment does not admit of any other method.

A series of rounds fired with the same fuze-setting, but at varying Q.E's, as the target is followed by the layers, will obviously produce bursts at varying heights. The difference in height between the first and last burst is termed the "height zone," and its size is determined by the number of rounds fired in each series. In some of the later types of H.F.I., two pointers are employed in place of the single pointer indicating the "future position"; these being placed on either side of the "future position." Fire is opened as the leading pointer crosses the curve of the fuze being employed, and is stopped when the second pointer crosses this curve; the number of rounds in each series depending on the interval between the two pointers, and the course of the target.

In this way, the size of the interval between the pointers regulates the height zone obtained.

On purely theoretical grounds, it would appear desirable that this zone should be kept constant, and that its size should depend on the accuracy with which the original height has been determined.

This is not always possible in practice; the reason being that, if a height zone is to be effectively covered, fire must be continuous throughout the series, whereas, when the target flies on certain courses, the change in Q.E. is very slow, and the time required to cover a reasonable height zone becomes prohibitive.

A compromise has therefore to be made, and the interval between pointers is adjusted to obtain a height zone as nearly constant as a reasonable duration of continuous fire will allow.

The above is an outline of the method of determining the fuze-setting to be employed. It is reasonably satisfactory in itself, but requires factors, the measurement of which cannot at present be accurately made

Turning now to the question of producing a trajectory to pass through the "future position." An attempt having been made to

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measure the change in bearing and angle of sight that will take place during the travel of the target from the present to the future position, on the lines already discussed; these angles, known as the lateral and vertical deflections respectively, are applied to the sights of the gun; the result being that when the sights are aligned on the target, the gun will be pointing directly at the "future position."

A difficulty here arises with regard to the lateral deflection. With present equipments this is applied in the plane of sight; that is to say, the sights are moved laterally about a pivot at right angles to the plane of sight, and not about a vertical pivot. As a result of this, the application of the lateral deflection causes an alteration in the total Q.E. of the gun, and hence produces an error. The amount of this error is very small, and in most cases is neglected; but in some types of sighting gear, allowance is made for this when applying the vertical deflection.

The gun being now pointed directly at the future position of the target the necessary T.E. remains to be added.

Here again the anti-aircraft gunner encounters difficulties, which do not present themselves in the case of gunnery on the flat. The first of these is due to the fact that he is engaging targets at considerable angles of sight, and the T.E. required for a given range along the line of sight, does not remain constant, but varies as the angle of sight changes. The actual T.E's required are not connected by any simple law, but are originally found by experiment and incorporated in the range table.

Since it has been decided that only whole fuze settings will be employed in anti-aircraft firing, it becomes necessary to construct a T.E. dial which, for a given fuze setting, will produce a burst on the line of sight; this being the reverse procedure to that adopted in most other forms of gunnery, where the fuze setting is usually calculated to conform to a given T.E.

As a consequence of this, the T.E. dial on an A.A. gun is graduated, not in yards of range, but in curves of fuze setting; so calculated that, if the T.E. dial be revolved until the pointer lies on a given fuze curve, the correct amount of T.E. is put on to ensure a round, set at that fuze, bursting on the line of sight; the pointer being arranged to vary its position according to the angle of sight.

Two factors govern the construction of these curves; firstly, the variation in T.E. for a given range at different angles of sight; secondly, the varying time of burning of fuze settings, fired at different heights, and the consequent variation of range thereby entailed. The latter is of considerable importance, as the variation in time of burning of fuzes is large; in some cases being as much as 50%.

For these reasons, the composition time fuze is not popular with anti-aircraft gunners, especially since, at heights of over 16,000 feet, it will frequently fail to function. The introduction of a mechanical fuze would be a great advancement in the simplification of this part of the problem, and it is to be hoped that its advent will not be long delayed.

A method, employing the same principles as the above, but differing in the method of applying them, has been under consideration for the past two years. In this method an instrument is employed,

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entirely separate from the guns, which produces the final Q.E. and bearing, and the guns are then kept layed by being set to this Q.E. and bearing, and not by direct laying. The method is analogous with the Case III firing employed in Coast Defence.

The advantages from a practical point of view are very considerable, especially where a large number of guns are under a single control. Saving of personnel is effected, and the number of layers required is reduced to two, independant of the number of guns being employed. These layers enjoy immunity from the shock and vibration of the gun's discharge, and, since there is no weight on the elevating and traversing gears of the sighting telescopes, they are able to maintain a more accurate lay.

The danger of guns being layed on different targets is also avoided as well as the delay in pointing out the target to the layers.

The results of experiments with these instruments have been distinctly promising, but they require considerable improvement to perfect them.

Another great difficulty in directing anti-aircraft fire lies in determining the allowance required to compensate for wind.

The wind that prevails on the ground level gives no indication of the direction or force of those which are prevalent on the higher levels. Therefore, before the required compensation can be arrived at, it is necessary to determine the "equivalent constant wind." This may be roughly described as the theoretical constant wind which would produce the same effect on the trajectory as the actual winds blowing.

When this has been determined, it is applied to a "wind deflection instrument," which will then record the lateral, vertical, and height corrections, necessary to compensate for the effect of the winds.

Unfortunately the magnitude of the "equivalent constant wind" varies for every different Q.E. Were this taken into account, the method would become altogether too complicated for practical use. It is therefore calculated for an average Q.E., and assumed constant throughout. This gives a result sufficiently accurate for practical purposes.

The above is an outline of the problem of attacking aerial targets with artillery. The immediate requirements to ensure an increase in accuracy and efficiency may be summarised as follows:—

Firstly, an improvement in the theoretical knowledge of the officers concerned who should be *selected* for employment with A.A. This is a new branch of gunnery, and the best brains and most capable officers are required if it is to be made a success.

Secondly, the design and employment of a gun and mounting considerably more accurate than those at present in use, and which will fire a shell having a high ballistic co-efficient, in order to reduce the times of flight as much as possible.

Thirdly, the introduction of a practical instrument to predict with accuracy the change in position of the target during the time of flight.

The growth of any new science must of necessity be slow and laborious; but the realisation of the above desiderata would cause a rapid advance to be made in the accuracy of Artillery Attack on Aircraft.

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ANTI-TANK DEFENCE.

By Major A. K. Hay, D.S.O., O.B.E., R.F.A.

"The constant birth of new ideas has demanded the exercise of the greatest "care, not only to ensure that no device or suggestion of real value should be "overlooked or discouraged, but also to regulate the enthusiasm of the specialist "and prevent each new development assuming dimensions out of proportion to "its real value".

"The Final Despatch" of Sir Douglas Haig.

THE experience of British Officers in the use of tanks as an aid to the offensive surpasses that of all other nations.

It may be said that every Britisher, in or outside the Army, has devoted thought to this question.

Before passing to the main subject of this paper, it is interesting to note the general direction of a new development of modern war.

To quote a distinguished Tank Corps Officer, this new trend is to attack the "brains" of an Army, as a prelude to, or in conjunction with, an attack upon the "body."

Nor is this development limited to tank attack only, but rather is it due to the progress of science generally, notably by aerial attack, long-range gun fire, and by chemical progress.

The term "brains" include all the arteries, nerves and muscles by which the "body" is supplied, controlled and directed.

In former days, provided that elementary strategical principles have been followed, these headquarters and communications have been immune from attack, sheltering themselves behind the "body" of the field army.

This is no longer the case.

In his recent speech introducing the Army Estimates, the Secretary of State for War described the latest developments in the design of a fast-moving tank.

One can imagine, on a moonlight night or a foggy day, a thousand such tanks launched to the attack, with the object of passing rapidly through the "body" to attack the "brains."

Such an attack might be the prelude to a great offensive by infantry and slow-moving tanks, directed against a "body" whose "brains" are being gnawed by ferrets.

Let us examine our anti-tank defences, and consider which, if any, of our weapons could be reasonably expected to prevent a large proportion of these tanks attaining their object?

As regards anti-tank defence, the shoe is on the other foot. British Officers have little or no practical experience of this important portion of the defence.

For the fruits of experience we must turn to the German.

There is no intention of wearying the reader by a series of quotations from Ludendorff, "Weekly Tank Notes," or Intelligence Summaries.

In considering the subject we must, however, avoid the principal error into which the German fell, namely, lack of imagination.

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No sooner had he evolved a means of defence based on his previous experience, than British inventors and manufacturers produced a tank against which these means were ineffective.

In short, the Germans did not look far enough ahead to foresee the next development of the tank, with the result that their anti-tank weapons were usually ineffective when opposed to the next tank attack.

To allege that our own weapons were, and are, antiquated for such a purpose, would be the height of politeness.

Had we been faced with the necessity for really up-to-date anti-tank weapons, there is little doubt but that British ingenuity would have evolved them.

In the future we shall be faced with this necessity. There is no so-called civilised nation which is not devoting its attention to tank research and development.

If this be accepted as a probability, therein lies the justification for this attempt to sketch the general system of anti-tank defence, and the lines on which the development of weapons should be sought.

Finally, without becoming involved in prophecy as to mechanical details, it seems safe to assume that the tank with which we shall have to contend will be superior to the present types, at least as regards speed, handiness, radius of action, reliability, power of surmounting obstacles, armour, and armament.

MEANS AVAILABLE AND THEIR LIMITATIONS.

Broadly speaking, the means of anti-tank defence are of two types, obstacles and weapons. Again, obstacles are of two kinds, natural or artificial. It is important to note that all obstacles are less effective by day than by night.

NATURAL OBSTACLES.

Such as water, marshes, mountains and thick woods, etc. Their weakness lies in the fact that they may not exist just where they are required, and further, that the tank of the future may be less impeded by them than its predecessors.

Suffice it to say that, where they exist, the fullest possible use should be made of natural protective obstacles, when selecting a defensive position. This point should be inculcated by our peace training, at field days, staff tours, promotion examinations and so forth.

ARTIFICIAL OBSTACLES.

Such as mines, gas, inundations, traps and stops of all kinds.

The majority of this type are dependent upon material, time, and labour, and are consequently unsuited to moving warfare.

Gas, traps, stops, etc., may prove less effective in the future, whilst mines are a constant source of inconvenience and danger to our own troops.

Within these limitations, they will undoubtedly be developed in stationary warfare.

It is suggested that a standardised type of portable mine should be introduced.

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WEAPONS AND THEIR TACTICAL EMPLOYMENT.

Note that all weapons tend to be more effective by day than by night, the very opposite of obstacles, but may be blinded by smoke or fog.

Anti-tank weapons and their employment in the general scheme of defence will be considered by arms, viz: infantry, machine guns, artillery, and tanks themselves.

No attempt will be made to forecast any form of aerial defence against tanks, since there is insufficient solid data upon which to base it. Both arms are developing at such a pace that it is not yet apparent to what extent, if at all, the aeroplane will be able to attack tanks effectively.

INFANTRY DEFENCE.

1. The infantry weapons available for use against tanks are the rifle, Lewis gun, hand or rifle grenade, and light trench mortar.

While the rifle may in time give way to an automatic rifle, and the Lewis gun to a light machine gun, neither of these weapons can be made effective against tanks and at the same time retain their essential lightness. Bullets or smoke grenades may harass the drivers, but cannot be regarded as tank destroying weapons.

Human nature is capable of great sacrifices, but it is unreasonable to order only one degree of resistance for infantry, unless they are provided with a sporting chance against advancing tanks, in the shape of some weapon for their immediate protection at comparatively short range. On moral grounds alone the provision of some such weapon is justified. The introduction of a short, light, one-man anti-tank rifle is advocated, on a scale of from 2 to 4 a platoon. The type suggested is on the lines of a ·577 double-barrelled high velocity rifle, shortened, and designed for fire up to about 300 yards.

2. Ludendorff claims that the German infantry destroyed large numbers of our tanks by the use of "multiple hand-grenades," i.e., two or more tied together.

It may be so, but the striking velocity or penetration of such weapons is very limited.

Experiments with hand and rifle grenades, provided with percussion fuzes and increased bursting charges, should be worth trial. The nature of their trajectory and their comparative inaccuracy do not offer much hope of success against a fast moving "jinking" tank.

3. There remains the light trench mortar. In its present form this is, admittedly, an unsatisfactory weapon from every point of view.

Much has been written recently upon the necessity for an "infantry gun," alternating from a mountain gun or howitzer to the German light minenwerfer.

Let us hope that it will be provided in due course, and that weight will be given to considerations of anti-tank defence in the design of both gun and carriage.

4. From this brief survey of infantry weapons it is clearly impracticable at present that each individual soldier can be provided with an efficient tank-stopper.

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It follows that anything resembling infantry defence in line formation is unsuitable, since the line will give way at points unprovided with anti-tank weapons.

Moral and efficiency will be maintained if the infantry are arranged in "groups," each group including a proportion of anti-tank weapons.

To cope with numbers of fast moving tanks, depth of defence is clearly essential.

It appears then that our existing defensive organisation is suitable, that is, mutually supporting localities (or groups) arranged in depth.

At the end of the war the Germans formed "tank-forts" on similar lines, a highly organised one containing as much as:—

2 field guns.
2 to 3 flat trajectory, light minenwerfer.
2 to 3 heavy machine guns.
3 to 4 anti-tank rifles.
2 portable searchlights (note what this item implies!)

in addition to the infantry garrison of the locality, or "fort."

When time and labour admit these localities should be strengthened against direct assault by artificial obstacles, mines, and the like. The organisation is not, however, confined to stationary warfare only.

According to the efficiency of the weapons, strength of the obstacles, and above all the stoutness of the defenders, the tanks will tend to avoid assault and sheer off to the intervals.

Here the other arms will be the mainstay of the defence.

MACHINE GUN DEFENCE.

The bullet of the ·303 Vickers gun will not penetrate the tank of the future.

Further, aircraft may elect to don armour to a greater extent, as power increases.

It seems certain that we shall require a heavy machine gun of ·500 or greater calibre, provided with armour-piercing bullets.

Gradually experience will show what proportion of the battalion's machine guns should be of the heavy type.

Whilst one or more of these heavy machine guns may be included within the defence of important localities, the remainder will probably be arranged in depth to flank the posts and cover the intervals.

In every case the guns would be sited for all round fire, and under stationary conditions placed, perhaps, in concrete pill-boxes.

It is difficult to see where the race between machine gun calibre and tank armour will end, although there is clearly a limit to both.

In this connection it is suggested that the protection of the tank might be increased by the mere shape of its armour, i.e., a "streamline" nose, and curving sides on the principle of the "tin-hat."

ARTILLERY DEFENCE.

1. A German order issued at the end of the war stated: "The FIRST duty of the field artillery is to keep off the enemy tanks. ALL other duties must give way to this."

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It has been said that this order was the consequence of a state of panic.

At all events it provides matter for thought by Field Artillery Officers as to the extent to which anti-tank defence will be the duty of the field artillery, the degree of importance it may assume in relation to other defensive duties, the methods best calculated to produce an effective anti-tank defence, and the type of equipment required.

2. The first point for decision is whether the field artillery should provide the artillery portion of the anti-tank defence, or whether a special type of gun is required, manned by another branch of the Regiment.

The necessity for a special anti-tank gun on a pivot or pedestal mounting is frequently advocated.

Such a mounting tends to be immobile, requiring as it does some special form of bed for its instalment.

The disadvantages of adding to the types of guns and ammunition in use are well known. It is hard to see what other functions such a gun could perform. A tank attack does not take place every day, or even week, and unless such a gun can perform efficiently other artillery duties its existence is not justified.

It is a principle of defence that the purely passive element should be reduced to a minimum, and the offensive portion increased relatively. The principle applies equally to artillery. Fixed guns in direct fire positions are necessarily "silent" and therefore passive in nature.

The artillery of the defence will seldom be so strong that it can afford to allot many guns to a passive rôle.

We are led to the conclusion that where artillery is concerned the very essence of anti-tank defence is MOBILITY, enabling the field artillery proper to alternate rapidly from its normal defensive rôle to the offensive one of a direct fire attack against tanks. If this can be carried out we shall achieve economy of force. In moving warfare, MOBILITY is still more important, in so far that time does not permit of elaborate obstacles, and the anti-tank defence will fall more and more upon the artillery. The artillery anti-tank weapon must be capable also of accompanying infantry in the attack, to guard the flanks and cover consolidation against tank counter-attacks.

3. Let us assume that in our dispositions for defence certain guns have been placed in direct fire positions within the more important defended localities, supplementing the infantry garrisons. Bearing in mind that detachments make for weakness, and that such guns will be lost to the side except in the event of tank attack, it is certain that their number will not be large. If we accept the principle that the ordinary field artillery are to undertake anti-tank defence, these "silent" guns will be mounted on field carriages.

So far we have broken no new or difficult ground. The portion of the subject on which light is required is the rôle of the remainder of the field artillery.

4. Just before, or at the moment the attack is launched, the bulk of the field artillery will be employed on counter-preparation or barrage tasks.

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By itself this cannot be expected to stop large numbers of advancing tanks, against which indirect fire is admittedly of little value. Assuming that the hostile tanks and infantry succeed in breaking into our outpost system, the continuance of counter-preparation by the field artillery would appear wasteful. Further, the difficulty of knowing when and where to bring back a barrage, within our own lines, is one of the outstanding artillery lessons of the war.

Only by rapid and resolute action can the field artillery hope to regain at this period an effective participation in the fight.

To remain behind the main line of resistance in their normal covered positions is to court disaster, since indirect fire will not stop the tanks, and the opportunity for direct fire will not arise until the main line of resistance has been penetrated.

As soon as the advance of tanks is reported, a proportion of the field artillery should advance at once, and at full speed, to previously selected direct fire positions.

Individual circumstances of ground, etc., alone can decide the proportion of guns which should form the first echelon of the artillery advance.

Generally speaking, the positions to be occupied should cover the approaches to the main line of resistance, or any other localities whose retention is essential to the defence.

Although the advance of many of the guns may involve no great distance, speed is VITAL, and running-up by hand will usually be out of the question.

Far from regarding this rapid change from indirect to direct fire positions as the abnormal procedure adopted only in the event of tank attack, it is considered that to a varying degree this should constitute the ordinary tactics of field artillery when ANY serious attack develops.

5. Horses are not and cannot be at the gun line when the attack is a surprise. They are so vulnerable that, even in moving warfare, we send them to some distance from the battery position. They are slow coming up, slow hooking in and limbering up, particularly under the shell fire which may be anticipated; vulnerable on the move, especially to machine gun fire from tanks, and unsuited for rapid movement over the shell holes, wire, trenches and other obstacles of the modern battlefield.

Setting aside the arguments against the horse on the score of economy, man-power, road space, etc., we arrive at the conclusion that horse teams are TACTICALLY unsuited to the situation we have in view.

The occasion brooks of no delay, and we cannot risk the guns being immobilised en route, or on arrival.

6. The obvious alternative is mechanical propulsion or traction. To avoid a lengthy technical discussion of the merits of each system, we prefer to advocate a mechanically propelled vehicle, as more suited to this particular situation than a gun drawn by a tractor.

In the near future, a reliable armoured tank chassis, carrying a field gun, crew, and ammunition, should present no great mechanical difficulties.

7. Lastly there is the question of the gun and mounting, or carriage.

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Apart from the small proportion of "silent" guns allotted to fixed anti-tank positions (para. 3), there are many situations in which it may be desirable to dismount the gun and fire it from the ground, sending the tank carrier away to cover, or for repairs, etc.

A field carriage seems desirable, which can be fired from the tank, or dismounted rapidly and fired from the ground.

When on the tank the wheels might be removed and the carriage secured by the axletree to a bracket. It is not proposed to enter into details of design, which must necessarily depend upon experiment.

Rapid and extensive traverse on the carriage is essential for anti-tank work, whether the gun is used from the ground, or from the tank.

This could be met by a split-trail design, on the lines of the present Italian 75$^{m}/_{m}$ field carriage (De Port pattern).

Finally, we should ensure protection to the detachment by the usual gun shield, combined with the flank protection afforded by the armoured sides of the chassis.

This protection, against all but direct hits from shells, will confer great opportunity for bold handling, enabling the guns to be driven into action in the face of rifle fire, or machine gun fire from tanks.

Mounted as suggested, it is thought that we have in the new 18-pounder, a gun suited to both normal field artillery duties, and also to anti-tank work.

TANK DEFENCE.

1. Ludendorff wrote that "tanks are only effective in masses." According as our defence is effective or otherwise will depend the numbers of tanks which succeed in reaching our battle position.

At all events it should prevent large numbers breaking through the main line of resistance simultaneously on a wide front; at some points we may expect to hold them up or even annihilate them, whilst at others, certain numbers assuredly may break through our main line of resistance. Such tanks as succeed in breaking through, will possess tactical flanks, where their comrades have failed to achieve similar penetration. The main line of resistance, presumably, is of vital importance to the defender. Tactical principles teach us that where ground vital to the defence has been temporarily lost, an immediate counter-attack should be made by local reserves to regain it.

2. In this case the counter-attack arm "par excellence" is the tank itself.

We have seen that in all probability a tactical flank can be found against which to launch this immediate counter-stroke. Tanks advancing in line present a larger target surface from the flank than from the front, and further, they share with other arms the inability to fire to a flank without masking each others fire to some extent.

It is clear that the opportunity for action will be of the most fleeting duration, calling for the same rapid decision by the Tank Commander on the spot, as is frequently demanded of a Cavalry leader.

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The tank reserves should be held ready for instant action in concealed lying-up places in rear of the battle position. The distance between these tank lairs and the battle position must allow of their reaching the latter in sufficient time.

The enemy tanks have the initial advantage of time, gained by surprise.

From this it is clear that the tank reserves should consist of high speed machines only, since upon their speed will depend the distance from the front at which they may be held, and their consequent immunity from ordinary shell fire.

3. The tank counter-attack should be supported by a concentrated fire of field artillery. We have seen already a proportion of the field artillery move forward to protect the battle position from direct fire positions. Batteries in the vicinity of the break through, which so far have not changed position, should now move at full speed to positions from which they can support our counter-attack by direct fire. The situation contemplated is precisely similar to the combination of fire and shock action by Horse Artillery and Cavalry—see diagram on page 270 of either Cavalry or Field Artillery Training.

For this situation also, mobility is the governing factor, and the armoured tank-chassis field gun is more suitable than the horse-drawn, since at least a portion of the action may be fought under machine gun fire.

The question arises whether the gun will not be fired from the tank whilst moving.

Though this undoubtedly will happen in emergency, it is thought that as a rule artillery should come to a halt, and rely upon the greater accuracy thus obtained, together with greater fire and shell power; leaving to our own tanks, with their lighter armament, the combination of fire and movement.

It is to be noted that the tank-chassis field gun will never attain quite the same degree of mobility as the tank proper, on account of its increased weight.

CONCLUSION.

It may be well said that in peace the cry is always "mobility," but in war "shell power."

Since the horse accompanied his less docile companions up the gangway of the Ark, the capacity of six horses has limited the shell power of Horse and Field Artillery.

Mobility has been attainable only at the expense of shell power, which is extremely undesirable.

As surely as the London bus-horse, our friend of South African days, has disappeared from the London streets, as surely will our beloved artillery horses give place to machinery.

When mobility has increased by say tenfold, will the Horse Artillery remain content with the 13-pounder?

Obviously, increased shell-power is the natural corollary, but the mobility must be augmented first.

We have no desire to advocate a rash plunge in the direction indicated, far from it. Such a revolution as it entails can be the outcome only of the most careful and exhaustive experiments.

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We have broken half the back of the problem by our great strides in tank development.

No real progress will be achieved until the majority of Officers are convinced that the necessary stage of mechanical improvement has been reached.

Meanwhile, our support may assist those who are responsible for research to traverse more rapidly the intervening stages of development.

This paper is put forward with a two-fold object; to serve as a somewhat wobbly "nine-pin" on the difficult question of anti-tank defence, and to reinforce the arguments of those who believe in a "mechanical era" for the Regiment.

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A METHOD OF CALIBRATING GUNS IN POSITION.

By Capt. C. H. Bosanquet, R.E.

THE object of the present paper is to describe a method of calibration which was tried by the writer in February 1917, and which, so far as the writer is aware, has not been employed at any other time.

The method depends on the measurement of the interval between shell wave and gun report, at a surveyed point near the line of fire.

Owing to the extremely laborious nature of the preliminary calculations, work on the method was discontinued after the introduction of screen calibration in France, and the complete analysis of the results actually obtained was never finished, owing to the loss through enemy action of all the data and calculations. Sufficient results were however obtained to demonstrate the practicability of the method.

The experiments were carried out on 11/2/17 at Pommier, the battery calibrated being 135 H.B., 60 pdrs. Three rounds per gun were fired at an elevation of about 11°, and the time intervals were measured by means of an ordinary sound ranging microphone and chronograph, the microphone being about 2000ˣ in front of the guns and 100ˣ from the line of fire.

The method adopted was to calculate the theoretical interval, assuming three different muzzle velocities; the actual and theoretical intervals for each gun were then compared, and the muzzle velocity deduced by interpolation.

The actual intervals were about 1·4 secs. and a change in M.V. of 10 f.s. caused a change in the interval of about 0·014 secs; the intervals were easily read to 0·002 secs.

The results obtained were all within 15 f.s. of the M.Vs. obtained by registration on a datum point, the mean M.V. of the battery by the two methods differed by about 8 f.s. These differences were of the same order as the variations of M.V. from round to round for the same gun, the average deviation from the mean of a single round being about 10 f.s.

The calculations were carried out as follows. First the co-ordinates of a number of points on the trajectory, and the directions of the tangents and the remaining velocities at these points, were computed from the range table. The imaginary figures given below will show the method employed. The difference between range and curve length of the trajectory was neglected, as only ranges up to 1500ˣ were dealt with, and the difference only amounts to a few inches.

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Imaginary extract from range table.

Range.	Angle of Elevation.	Angle of Descent.	Remaining Velocity.	Time of Flight secs.	M.V. 2080 Jump – 30′
100ˣ	34′	4′	2039	0·146	
200ˣ	38′	9′	2000	0·294	

Air temp. 40° F. Barometer 29·2″. Following wind 20 f.s.
Elevation 11° 30′.
Initial air speed of shell 2060 f.s.

Mean $\frac{\text{air speed}}{\text{ground speed}}$ for first $100^{\text{x}} = 0{\cdot}990$

$$\frac{\text{Density of air}}{\text{Standard Density}} = \frac{29{\cdot}2}{30} \times \frac{519}{499} = 1{\cdot}012$$

True elevation = 11° 00′.
∴Loss of velocity in $100^{\text{x}} = 40{\cdot}0 \times 1{\cdot}012 \times 0{\cdot}990 + 0{\cdot}146 \times 32{\cdot}2 \sin 11° 00′ = 40{\cdot}08 + 0{\cdot}90 = 40{\cdot}98$ f.s.
∴remaining velocity is 2039 f.s. at a distance of $100{\cdot}05^{\text{x}}$ from the gun, and time of flight to that point is 0·1461 secs.

In this way the co-ordinates of the shell corresponding to different remaining velocities were calculated, the trajectory being computed in steps of about 100^{x}; owing to the small curvative of the trajectory, non-rigidity corrections were unnecessary.

Times of flight were computed for each 100^{x} from the remaining velocities, and three range tables were computed, assuming different M.Vs. The actual M.Vs. assumed were the theoretical M.V. for which the table was constructed, the remaining velocity after 200^{x} and the remaining velocity after 400^{x}.

The sum of the times taken, by the shell to reach a point on the trajectory, and by sound in travelling from that point to the microphone, was then calculated for several points on the trajectory, and the point on the trajectory corresponding to the minimum time was found by interpolation. The difference between that minimum time, and the time taken by the sound of the report to reach the microphone, gave the interval sought. The actual M.V. of the gun was then deduced by interpolation, as stated above.

The position of the shell for the minimum time was actually calculated by a rigorous method, but the accuracy of the method does not justify the labour involved; it is sufficiently accurate to use parabolic interpolation, the interval being calculated for three adjacent points on the trajectory, bracketing the point required. It is then assumed that the interval corresponding to a point on the trajectory differs from the minimum by an amount proportional to the square of its distance from the point corresponding to the minimum interval.

An example will make this clear; let the time intervals corresponding to points 1200^{x}, 1300^{x} and 1400^{x} from the gun be 4·793, 4·787 and 4·819 seconds respectively, then the minimum point obviously lies between 1200^{x} and 1300^{x}, let it be at $1300 - x$.

Let the actual minimum interval $= a$ seconds.

Then $a + (100 - x)^2 b = 4{\cdot}793$ where b is some constant
$a + x^2 b = 4{\cdot}787$
$a + (100 + x)^2 b = 4{\cdot}819$

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Solving for a, the only value required, gives the minimum interval = 4·785 secs.

$$x = 34{\cdot}2$$
$$b = 0{\cdot}000\ 0019.$$

This time interval, 4·785 secs., subtracted from the time taken by the sound of the report to reach the microphone, gives the shell wave-gun report interval for the particular M.V. used in the calculations.

In order to compare the M.Vs. of the guns independently of any fluctuations in the wind, the guns were fired at 3 seconds interval, so that all guns were fired under exactly the same conditions. The guns should either be paralleled or else converged so that they are all firing exactly over the microphone. This simplifies the calculations. All guns should be fired at exactly the same elevation, and the elevation should be small if the best results are to be obtained. As the experimental shoot was carried out with the guns converged on the target, and all guns fired at different elevations, the time taken over the calculations was about 30 working hours, including computing all the range tables necessary, but some of the methods used were unnecessarily laborious. By using the quicker methods explained above, and paralleling guns, the time could probably be reduced to 8 hours without difficulty, and if tables were prepared for assisting the computation, two hours would probably suffice.

The table which would prove most useful would give the co-ordinates of the shell after successive fifths of a second, for two or three standard elevations, together with wind and temperature corrections. These tables could be prepared for two different values of the M.V., and they would be quite short, as they do not require to be extended beyond the point where the shell drops to the velocity of sound.

The method is intermediate between screen calibration and calibration on a datum point, being in effect a measurement of time of flight over 1000^{x} or so.

Increased accuracy would be attained by placing a second microphone near the guns, so as to record the actual instant of firing.

A possible source of error is the increased velocity of sound in the first few yards near an intense source, but the results show that this effect cannot be very large, and it is cancelled out altogether if relative velocities only are required.

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THE CONTINUOUS LINE IN OPEN WARFARE.

BY COL. H. ROWAN-ROBINSON, C.M.G., D.S.O., R.A.

THERE is but little doubt but that, prior to entering upon a period of moving warfare, G.H.Q. and all other Headquarters-Army, Corps and Divisional—should have been sent into dry dock for a course of barnacle scraping in order to remove the deadening effects of three years' experience of trench warfare. To say this is to cast no reflection upon the capacity of a body of officers, a large proportion of whom were men of outstanding merit. It is merely an assertion that even great men are human and therefore subject, like lesser mortals, to laws and limitations of habit and environment. It was quite possible that a few of the more gifted and original characters might have shaken themselves free from these shackles without assistance, but it was quite certain that the majority would not. Battalions and batteries were indeed freely exercised behind the lines in the old pre-war movements in preparation for the great advance, but the headquarters of formations failed to realize that they, far more than the troops, required exercise in the methods of open warfare. Not a little brain-work and some imagination were needed on their part to visualize their new functions and to prepare for the quick change necessary not only in form of action but also in habits of thought. But it was not always exerted. The binding net of the communication system acted banefully on all initiative; the accumulated stores of comforts were not reduced; the conventional methods of playing for safety were not abandoned. Sir Douglas Haig, indeed, issued an order to the effect that risks dangerous and even criminal in trench warfare might be freely accepted and even sought in the war of pursuit. Actually but few risks were taken, however, and many opportunities were consequently lost. The secret of success in the advance lay in superiority in numbers and equipment and in solid and skilful preparations rather than in any daring conceptions the result of which might have turned the German withdrawal into a rout. The world is still suffering from the effects of this over-caution in that the German is now adopting the satisfactory belief that he was never really beaten.

One of the shackles of Siege Warfare never shed was that of the continuous line. Its vitiating influence was sorely felt in the retreat of March 1918. In the official and non-official reports of every Corps or Division that took part was to be found repeatedly such a sentence as —"The Corps (or Division) on my left (or right) having fallen back, the Nth Corps (or Division) withdrew to conform". Similar statements were to be drawn from any man or any party straggling back: "My platoon (or Company, etc.) was doing

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splendidly and could have held on for ever but the platoon (or Company, etc.) on our right (or left) fell back." Such remarks were heard with lamentable frequency.

The fact is there should have been no continuous line. Each Corps is strong enough to fight its own battle, whether in advance or retreat, provided it be served well with intelligence and gets general instructions from Army Headquarters. The continuous line is most unsatisfactory for an army in movement. As indicated above, it was considered necessary for a whole line to retreat if once penetrated; and the reason is obvious. It is only in trench warfare that a long line can be held and then its safety depends on deep and complicated systems and a thorough organisation of all the artillery and reserves for the protection of every portion in the line. In the moving battle this is clearly out of the question. The long line disperses the available men, makes supply, reinforcement, artillery support and a well-timed well-covered advance or withdrawal exceedingly difficult. In the advance, extension tends to slowness, owing to the need for adjusting the general pace to the slower moving portions of the line in order to maintain connection, and prevent the formation of dangerous salients. It also tends to loss of power, weakness against counterstroke and above all to inability to exploit sudden advantages that may accrue. Replace this method by a group system, each group consisting, say, of one Corps and being allotted a certain portion of front. Both in advance and retreat the group can, if advisable, deploy to cover its own front, but would normally make use of advanced and rear-guards and have its main body ready to strike or to detach striking forces of all arms against any bodies of troops penetrating between groups. The fate of a Japanese Brigade at Mukden and more recently, the fate of the German Cavalry that reached the northern defences of Paris by passing between the British Army and the 6th French Army, furnish instances of the ease with which isolated bodies penetrating between well-handled groups can be destroyed. It is essential during movement to have at hand strong organized bodies on which reliance may be placed for taking what action may be necessary. These will never be available on the long line system and, therefore, when the latter comes up against the group system, the result should not be long in doubt. The maintenance throughout 1918 by all the great armies of a system so clearly unsound furnishes a noteworthy example of the ossification of brain usually consequent on prolonged periods of routine. Had the question been discussed in 1913, the possibility of open warfare in a continuous line would have been scouted. The sole advantages that can be claimed for it are—a wide choice of positions for artillery and a greater number of roads for the trains. But these advantages are illusory, for they postulate protection sufficient to give a sense of security which the system under discussion could never supply. And this feeling is very necessary to the gunner for the execution of his task. Without it he has to devote to precautionary measures a large part of his thoughts and some of his personnel which would be better employed exclusively in the solution of the artillery problem before him. That the continuous line carries

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with it the power of changing at any favourable moment from open to trench-warfare might also be claimed but on grounds that will not for a moment bear examination. It was with some such idea that a succession of lines was built early in 1918 in rear of the main battle lines when the great German offensive was expected. An immense amount of time and labour had been expended in their construction which might more profitably have been devoted to the training so seriously required after the heavy losses in experienced personnel incurred in Flanders. Dug-outs had been built, observation posts and battery positions laboriously prepared, immense quantities of ammunition stored therein, and acres of wire erected. Yet the enemy swept through them without a pause. And if a continuous line falling back into such heavily fortified positions fails completely in the task of holding the enemy, what prospects are there for an unfortunate line that has to dig in and fight at the same time? The case of Wellington's retreat into the Torres Vedras lines wears a wholly different aspect, in that he retired before Massena, not as a line but as a fighting group, and only entered a prepared and continuous line of trenches when his retreat was completed. The withdrawal of the Germans early in 1917 from the Somme battlefields to the Hindenburg line must also be classed in a different category as it had been long and secretly prepared and was carried out without any serious pressure. To refer the matter back to first principles—concentration is always better than dispersion—concentration of all available force at the decisive point at the right moment. It is an old saw, but none the less true for that, and its truth has not been in the least affected by the fact that for three years vast armies watched each other from frontier to frontier in close proximity without either being able to bring about an effective concentration against the other. It had, however, owing to the long failure to solve the technical problem involved, suffered grievous mutilation in the minds of the majority of leaders, although, prior to the war, there was no point of doctrine so universally assimilated.

It is curious that the Allies who based their strategy so largely upon Napoleonic methods should have deemed warfare so completely changed in a hundred years as to believe that the long thin line of 1918 could be the legitimate successor of the battalion square of the Jena campaign or of the group system of Napoleon's advance on Moscow Looking at the matter now when the trenches of France are fading fast, the latter methods appear even to-day more effective for striking blows. The French realized it well enough in early days. Langle de Cary's 4th Army, concentrated behind the centre of the French line as it first deployed, represented a *masse de manœuvre* ready to strike at any point where faulty German strategy offered a suitable opportunity; and, later, Manoury's 6th Army was formed for the same purpose and fulfilled it admirably.

Foch actually began his great offensive in 1918 by a powerful stroke effected on the same principle but after that one fine effort his method deteriorated into advances in long thin lines. Magnificent work was done but this mistaken policy vitiated the whole system and prevented the best results from being obtained.

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It is particularly necessary as regards our future teaching and training to draw attention to the weakness of the continuous line in open warfare because it was the method employed by the conquerors in their final advance and because its success may be held to justify a belief in its soundness although no startling victories resulted therefrom. Had the advance been carried out against an army equally numerous and equally well-equipped there would be grounds for such belief. The overwhelming superiority of the Allies, however, both in men and material, threw the enemy everywhere upon a defensive practically passive in its nature and prevented him from concentrating for a serious counter-attack. Thus no severe test was applied to the system, and the conclusions to be drawn from actual warfare in its favour are therefore almost of negative nature. The objections that may be raised against it have, on the other hand, a very positive value.

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A suggestion for a normal procedure for ARTILLERY SUPPORT OF INFANTRY, held up in definite localities, in moving warfare.

By Major & Bt. Lt.-Col. J. D. Belgrave, d.s.o., *psc.*, R.F.A.

FOUNDATIONS are now being laid of a doctrine on which the last-born member of the family of British armies is to be brought up. War experience is being sifted for material for peace training. Simultaneously, there is a process of reaction which may be dangerous. The national characteristic of individual independence, and its more modern successor—an intense independence of corporate bodies (e.g., Trade Unions and Political Parties)—were sunk in time of war when men and bodies of men were ready to receive, even at their temporary inconvenience, all the help which their fellows could give them. Now, that independence is being reasserted.

There was a time when liaison between our infantry and artillery was far from good, but the lessons of South Africa and of Manchuria were incorporated in our doctrine so that we were ready for the development which took place in this respect during the war. Gunners were ready to give, infantry ready to receive, even at the expense of delay, all possible support.

Yet the old problem of co-operation between them in moving warfare is not yet completely solved.

In the last great battle of 100 days, battalion and infantry brigade commanders knew well the galling delay which the need of artillery support too often involved.

Forward sections of guns contributed gallantly to the solution and are assured of their place in the future. Gunner liaison officers with infantry commanders were a help, but could not as a rule give executive orders to guns and so translate an infantry commander's wishes into shell. A battalion commander must be where he can best command his battalion, a battery commander where he can see the target and communicate direct with his guns; these positions did not often coincide. It was beginning to be realised that an infantry commander could more often go to the battery commander's position than vice-versa, at least he would there be best placed for observation. Where this could be done time was saved.

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Still the frequent report "held up by machine guns" meant a set-piece.

"Where exactly are the machine guns?"

"How long shall we shell them?"

"When shall we start?"

"When shall we lift off them?"

"Will that give time to let everyone know?"

How tired of such questions is a man who has been a battalion commander or a brigadier.

Is it purely as an incentive to a high standard of training, in machine guns, Lewis guns, rifle grenades and Stokes guns, that infantry officers are now heard to say "We relied too much on artillery, we must do it with our own weapons," or is there some reaction in these words?

In any case infantry will be glad to get guns to help if they can get them quickly.

The following suggestion is put forward in the hope of reducing the delay.

It is proposed that there should be a normal precedure for artillery support of infantry held up in front of a definite locality, in moving warfare. When, for instance, an artillery officer, whose guns are supporting a particular body of infantry, becomes aware either by observation or by means of a message that the infantry he is supporting is held up in front of a certain locality, he will order "normal support" from some or all of his guns on that locality. This will mean that these guns will, after firing any necessary ranging rounds at a slow rate, fire a burst of intense fire on the locality lasting for five minutes, pause for five minutes, fire an intense burst for seven minutes, using smoke shell for the last round of gun fire, then lift or cease fire so that infantry can assault. The timings are merely for example, they would be determined by experience and experiment so as to allow infantry ample time to prepare to assault.

The essential point is that company and platoon commanders must know exactly what to expect.

It may be objected that the enemy will also get to know what to expect. If so his anticipation will be unpleasant enough to compensate us for the loss of surprise.

The number and length of bursts of fire for this "normal artillery support" could be varied by orders issued from time to time, or could be arranged between infantry and artillery commanders concerned immediately before an advance.

If, for some reason such as the shell falling in the wrong place, the first attempt has been ineffective, a simple correction and request from the platoon commander in the front line, e.g., "normal artillery support, 200 yards more to the right and add 100 yards, repeat," might put the matter right in a short time compared to the long explanations which have often been necessary in such cases.

Such a procedure would tend to make relations between the two arms still more intimate.

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CO-OPERATION IN MOUNTAIN WARFARE.

By Major & Bt. Lt.-Col. A. F. V. Jarrett, m.c., R.G.A.

THE following notes on Captain Deane's article on this subject in the February Journal may be of interest; they are the result of independent experiments on the same lines with various Regiments, British and Indian, whose keenness on the subject I have found to be in direct proportion to their experience of frontier fighting and "dirty work" of a similar nature.

Firstly, as it is Co-operation, we must give way to Infantry prejudices; chief among which appears to be a rooted aversion to the compass and the word "bearing". Every battalion to whom, within my knowledge, the suggestion has been made that they should send down the bearing to the desired target, has rejected it with loathing; hence the "clock method", of which they all approve, and which certainly does, though with less accuracy than the compass, provide the chief ingredient for TOB. (This last, by the way, at any rate East of Suez, is not dead, nor even sleepeth).

It is wiser to cut down any signalling codes to the barest minimum; they are not well liked by infantry, and they certainly do lead to the difficulties caused by bad signalling to which Captain Deane alludes. I suggest that "TG" is an unnecessary refinement; the message will convey its meaning equally well without it. "J" and "F" are also refinements, and at the same time pitfalls to a trusting B.C. Infantry observers, not to mention Artillery ones, are apt to be optimistic. It is far better for the B.C. to bracket than to trust to distances estimated by any but the most expert.

The angle of sight is very necessary and is over lightly dismissed in the article; this more especially in frontier warfare where it is frequently in its teens. The infantry cannot be expected to measure the angle, but they can estimate the height of the target above or below them; even if this is to the nearest hundred feet it is better than nothing. It is hard for the B.C. without some such indication to know where to look for the target in hilly country; with this information included in the message (e.g. Plus 100) and the gunners rule, the B.C., even when he cannot see the target, can find his approximate angle of sight. It is obvious that the whole method can only be an approximation.

If the B.C. can see the target he does not really need the infantry observations; also infantry in need of artillery support are

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usually rather busy. It would be better for the B.C. to ask for observations (he might send Observe) when he needs them.

It is too much to expect the infantry to manage the "mental picture"—not every artilleryman can do it with success. It is enough if they send observations from their own point of view (e.g. Right and over); the B.C., knowing the apex angle, can, with the aid of a rough "grid", get a very good idea of where his shell are going, especially if he makes up his mind to bracket first for line and then for range.

Is the question of modified aeroplane ranging one for B.C's to decide? I respectfully suggest that these are matters for official decision. Major A may like these methods; his successor Major B (equally worthy) is quite likely to object to them; a state of things which, in these days when B.C's come and go with some rapidity, is apt to "ghebrow" the most enthusiastic subaltern.

The whole question is of the greatest interest to the Mountain Gunner, whose pride it is to be, even more than any other Gunner, the Infantryman's Friend and ever present help in time of trouble. The scheme is as yet, as Captain Deane says, in embryo; if anyone knows of a better method, would he kindly oblige?

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PRÉCIS OF REVUE MILITAIRE SUISSE.

April, 1920.

By Brig.-General H. A. Bethell, C.M.G. late R.A.

The Swiss Military Organisation.

The *Landsturm* (third line) had to guard the frontier in 1914. They had neither training nor organisation, and would have been helpless if attacked. There should be properly organised frontier guards, each unit of infantry and artillery told off to a definite section of the frontier.

Swiss Military Competitions.

Competitions in military ski-running, including long-distance patrols and similar exercises, are to be held next winter.

The New Hungarian Army.

The Russian Bolshevist Army is more efficient than is commonly supposed. It is well armed and disciplined, and is a formidable menace to Central Europe. If this threat is carried into effect, the Russians are most likely to advance through Galicia, where they will meet their bitter enemies, the Hungarians.

The present Hungarian government, under pressure from the Communists, have disbanded the Army. But Admiral Horthy, since February 1919, has raised a small but efficient volunteer army for national defence, known as the "*Move*."

Military Notes.

Ten thousand Swiss served in the French Foreign Legion during the war. At Villers-Bretonneux alone they lost 800 killed and 1,500 wounded.

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PRÉCIS OF MEMORIAL DE ARTILLERIA.

February, 1920.

By Brig.-Genl. H. A. Bethell, c.m.g., late R.A.

Distribution of Fire.

An elementary mathematical article on the distribution of the lines of fire of the guns of a battery, to cover a given target.

Theory of Explosion Motors.

Of no particular interest. The author recommends castor oil as a high-temperature lubricant. It vaporizes at 320 C. as against 250 C. for mineral oils.

Field Artillery of the Future.

General Le Gallais, in the "Revue Militaire Generale," considers that the French Army should have, in addition to the "75," (a) a 4·2″ high-velocity gun; (b) a 6″ howitzer; (c) a 6″ high-velocity gun; (d) heavy howitzers from 8″ to 16″; (e) special trench artillery. The divisional artillery should consist of 48 75$^{m/m}$ field guns, 12 4·2″ guns, and 24 6″ howitzers. The corps artillery should consist of 36 4·2″ guns, at least 24 6″ guns, 12 8″ howitzers, and 12 heavy howitzers. The army artillery should consist of guns of 6″ and upwards, and howitzers up to 16″, and should include the special trench artillery, which belongs to the ground, not to the divisions.—The Americans have arrived at much the same conclusions.—"La France Militaire" recommends that the equipment of the infantry should include "chars d'assaut" carrying light and heavy trench mortars.

Miscellaneous Notes.

An American multiple drilling machine (illustrated).—The battleship "Queen Elizabeth."—Wireless telegraphy from submarines. With the latest wireless equipment a submarine submerged 4 metres below the surface can receive messages at 600 miles. Extra powerful sending stations can be heard up to 1200 miles.—It is difficult to follow an aeroplane with a searchlight, because the vertical and horizontal pivots on which the projector rotates have no simple relation to the direction of the plane. French experiments have shown that an extra pivot in the mounting, which enables the vertical pivot to be inclined towards the plane, renders it comparatively easy to keep the beam on it.

British Tanks.

Details of Marks I to IX. The latest types, brought out just before the armistice, are fitted to transport a 6″ howitzer or 50 men.

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Rigid Dirigibles.

From "La Nature," December, 1919. This article contains a useful summary of the details of the principal dirigibles constructed up to date.

Sulphuric Acid.

This important product ran short during the war, and was successfully replaced by acid sulphate of soda. Interesting to students of chemistry.

Book Review.

"Anti-aircraft Ballistics," by Capt. Feigenspan, Spanish Artillery. An advanced mathematical treatise. Starting with the trajectory in vacuo, the author deduces ballistic formulæ for firing at aircraft at different altitudes.

CONTENTS OF REVUE MILITAIRE GÉNÉRALE.

April, 1920.

Général Thevenet. Concerning the first entry into Mulhouse by the French.

Col. Monsenergue. The action of the cavalry in Lorraine (Aug. Sept. 1914).

Comdt. Perney. Artillery in Defence.—One of the causes of a defeat.

This article describes the German attack on the Chemin des Dames and Ailette on May 27th, 1918.

The author only deals with the French Artillery dispositions, and points out that as there was no defence in depth by the Artillery there was nothing to prevent the Germans from crossing the Aisne.

NOTE.—Our 9th Corps was in this fight.—Readers will remember the gallant stand of the 5th Battery, R.F.A.

Comdt. P. Raoult. Ammunition Supply.

Captaine Hoff. The Problem of Breaking Through.

German opinions on the War.—Lieut.-Gen. Von Freytag Loringhoven—Part IV.

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GIFTS AND PURCHASES DURING THE MONTHS OF APRIL AND MAY, 1920.

APRIL.

Books Presented.

By the Secretary War Office.

"List of Range Tables (Land Service) corrected up to 1st Jan. 1920."

"Range Table for 18-pr. Q.F. Guns, Marks I—IV. (Firing Stream-Line Projectiles). (Full Charge) 1920."

By The Publishers.

"Map Reading made easy". By Capt. C. C. Esson and G. S. Philip, F.R.G.S. (G. Philip & Son, 32, Fleet Street, E.C. 4.) London, 1920. 3/6 net.

"Life of Lord Kitchener". By Sir George Arthur. 3 Vols. (Macmillan), London, 1920. £2/12/6 net.

By Major-Genl. C. R. Buckle, C.B., C.M.G., D.S.O.

"Instruction sur l'Action Offensive des Grandes Unites dans la Bataille." Paris, 1917.

By The Secretary, Institution of Mechanical Engineers.

"Proceedings of the Institution of Mechanical Engineers, Oct.-Dec., 1919."

Books Purchased.

"My Campaign in Mesopotamia". By Major-Genl. Sir Charles Townshend, K.C.B., D.S.O. (Thornton Butterworth) London, 1920. 28/- net.

"The Writers' and Artists Year Book, 1920." (Black). 3/6 net.

"Tanks in the Great War, 1914-18". By Bt. Col. J. F. C. Fuller, D.S.O. (Murray). London, 1920. 21/- net.

"Precepts and Judgments". By Marshal Foch. Translated by Hilaire Belloc. (Chapman & Hall). London, 1919. 9/- net.

"The Romance of the Battle-Line in France." By J. E. Courtenay Bodley. (Constable). London, 1919. 7/6 net.

"A Short History of the Great War". By A. F. Pollard. (Methuen). London, 1920. 10/6 net.

"The Bolshevik Adventure." By John Pollock. (Constable). London, 1919. 7/6 net.

"The Economic Consequences of the Peace." By J. M. Keynes. (Macmillan). London, 1920. 8/6 net.

"Chronology of the War, Volume II. 1916-17". Issued under the auspices of the Ministry of Information. (Constable). London, 1919. 7/6 net.

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Presented to the Museum.

By Mrs. Geddes (widow of Brig.-Genl. J. G. Geddes, C.B., C.M.G.)

A Telescopic Sight from a German Gun captured at Bourlon Wood.

By Viscountess Wolseley, through the Sec. R.U.S. Institution.

Frock-Coat, Overalls, Aiguilette, and Sash belonging to the late Viscount Wolseley.

MAY.

Books Presented.

By The Secretary, War Office.

"Report on the Examination for Certificate "A", held in November, 1919, for Cadets of the Junior & Senior Divisions, O.T.C."

"Range Table for 9·2-in B.L. Guns, Marks IX & X. 2 C.R.H. Projectiles. L.S. (Coast Defence) (Full Charge) 1919."

"Range Table for 9·2-in. B.L. Guns, Marks IX & X. 2 C.R.H. Projectiles. L.S. (Coast Defence) (Three Quarter Charge) 1919."

"Range and Projection Scales for 9·2-in B.L. Guns, Marks IX & X. 1920."

"Range Tables for 12-in B.L. Howitzers, Marks III., IV., V., & V*. (Charges 7 to 11). May, 1920."

"Range Table for 4-in. Q. F. Gun, Mark V. 3 C.R.H. Projectiles. L.S. (Coast Defence) May, 1920."

By The Author.

"War Services, 62nd West Riding Divisional Artillery". By Col. A. T. Anderson, C.M.G., R.A. Cambridge, 1920.

Books Purchased.

"La Genese de la Bataille de la Marne". Par le General H. LeGros. Paris, 1919. 3/6.

"The March on Paris, and the Battle of the Marne". By General Alexander von Kluck. With notes by the Historical Section (Military Branch) of the Committee of Imperial Defence. (Arnold) London, 1920. 10/6 net.

"The Battle of the Marne". By G. S. Perris. (Methuen) London, 1920. 10/6 net.

Presented to the Museum.

By Major R. S. Rothwell, D.S.O., R.G.A.

A Persian Flag captured at Bushire, Persia, 8th August, 1915.

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ARMY ORDER 12, 1920.

WAR OFFICE,

27th January, 1920.

EXAMINATION OF OFFICERS FOR PROMOTION.—1. With reference to Army Order 301 of 1914, it has been decided to re-introduce promotion examinations for Regular officers. The first written examination will be held in October, 1920.

2. The general scope of the examination for combatant branches will be as in the attached Appendix. A detailed syllabus of all the examinations will be issued later as amendments to King's Regulations, paragraphs 854—895 and Appendix XI.

3. The special technical examinations held before the war for officers of the Royal Artillery, Royal Engineers, Royal Army Service Corps, Royal Army Medical Corps and Royal Army Veterinary Corps will not be held in 1920.

4. Up to and including 31st December, 1921, officers will be considered for promotion on their records, but on and after 1st January, 1922, no officers will be considered eligible for promotion unless he has passed the necessary examination.

5. Cases may come to notice of officers commissioned since 4th August, 1914, who have not the qualifications in educational subjects to fit them to train their men to the necessary standard. Arrangements will be made in commands, &c., by which such officers may be allowed to pass through an educational course ending with a test conducted by a board of officers. If, as the result of this test, the examining board is of the opinion that the general educational standard of any candidate is not sufficiently high to warrant his retention as an officer the case will be referred, together with the papers and candidate's work in the examination, through the usual channels to the War Office. The Army Council will then decide whether the officer is to be retained in the Army or not.

6. General Officers Commanding will forward on Army Form B 2053 to reach the War Office, not later than 1st September, the names of officers in their command desirous of being examined in subjects (*b*) and (*d*) in the examination to be held in October, 1920.

By Command of the Army Council,

H. J. CREEDY.

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APPENDIX TO ARMY ORDER 12.

The examination of a second lieutenant for promotion to lieutenant is abolished, but a second lieutenant before promotion must have received satisfactory reports under paragraphs 138A and 140, King's Regulations. In the case of paragraph 140, King's Regulations this special report will be rendered on the officer completing 2 years' service. The first 2 years of an officer's service will be regarded as service on probation, and an officer may be called upon to resign his commission at any time during these 2 years if adversely reported on.

2. *Lieutenant to captain.*—The examination will be divided into two parts—

(*a*) *Practical.*—Consisting of a tactical exercise in the field without troops, embracing a knowledge of Artillery, Cavalry and Infantry Training, Field Service Regulations, map reading and field engineering.

(*b*) *Written.*—Consisting of four papers on—

(i) Military organization, military administration and military law.

(ii) Imperial military geography.

(iii) Military history. (The campaign to be studied will be announced in Army Orders.)

(iv) Tactics, map reading and field engineering.

No candidate will be allowed to sit for examination (*b*) (written), until he has passed examination (*a*) (practical). In addition to passing examinations (*a*) and (*b*) a lieutenant, before promotion to captain, will be required to undergo a course at an Army school of education and obtain a satisfactory certificate. A candidate who gains a special certificate* in (*a*) and (*b*):—

(i) Will be excused the examination (*c*) and (*d*) for promotion from captain to major.

(ii) Will receive consideration when put forward for accelerated promotion. The fact of his gaining a special certificate in this examination will be a factor in his favour.

(iii) Be eligible for consideration for appointment as an officer at the Royal Military Academy and the Royal Military College, with a view to subsequent consideration for nomination to the Staff College.

(iv) Will receive a credit of marks in the competitive examination for admission to the Staff College.

3. *Captain to major.*—The examination will be divided into two parts—

* The standard required for a special certificate will be announced with the detailed syllabus.

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(*c*) *Practical.*—Consisting of a tactical exercise in the field without troops, embodying the employment of a mixed force of all arms, *e.g.*, a troop of cavalry, a battery, two sections Royal Engineers, an infantry battalion, a machine-gun company and a section of tanks, and of such a nature as to test the candidate's capabilities in appreciating a situation, making a definite decision, and issuing his orders briefly, clearly and quickly.

(*d*) *Written.*—Consisting of five papers—

(i) Military organization, military administration and military law.

(ii) Short essay on a military subject. A choice of three subjects to be given.

(iii) Military history. (The campaign to be studied will be announced in Army Orders).

(iv) Development and constitution of the British Empire. Imperial military geography.

(v) Educational training.

No candidate will be allowed to sit for examination (*d*) (written) until he has passed examination (*c*) (practical).

A candidate who gains a special certificate* in (*c*) and (*d*)—

(i) Will receive consideration when put forward for accelerated promotion. The fact of his gaining a special certificate in this examination will be a factor in his favour.

(ii) Will be eligible for consideration for appointment as an officer at the Royal Military Academy and the Royal Military College, with a view to subsequent consideration for nomination to the Staff College.

(iii) Will receive a credit of marks in the competitive examination for admission to the Staff College.

4. *Tactical fitness for command.*—There will be no examination for tactical fitness for command (King's Regulations, paragraphs 880-888, Appendices XII and XIII, are cancelled). Before promotion to the rank of substantive lieut.-colonel an officer† will be required to undergo a course at a senior officers' school and obtain a satisfactory report.

In unforseen circumstances where a major becomes due for promotion before attending the senior officers' school he may be promoted provisionally on the understanding that he attends the first available course and gets a satisfactory certificate.

A major may not attend the course at the senior officers' school unless recommended for promotion in his annual confidential report.

* The standard required for a special certificate will be announced with the detailed syllabus.

† Except officers of the Royal Army Medical Corps and Royal Army Veterinary Corps.

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In very exceptional cases a general officer commanding may submit to the Army Council the name of a major to be excused attending the senior officers' school prior to promotion to substantive rank of lieutenant-colonel. It is essential that the officer should have held command of at least a battalion, or corresponding combatant unit, in the face of the enemy over an extended period.

5. An officer will not be allowed to enter for any promotion examination unless he can produce a certificate from his commanding officer to the effect that he has tested the officer and recommends him as fit to be examined for promotion. This certificate will be countersigned by the General Officer under whom the officer is serving, who will add his remarks.

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Just Published.

History of the 20th Divisional Artillery, 1914-19.

Compiled by Captain E. G. Earle, D.S.O., R.F.A.

This History, consisting of 40pp. of text, and three page photographs of the C.R.As., who commanded the Division from 1914 until the end of the War is "Dedicated to the Gallant Dead of the 20th Divisional Artillery."

Royal 8vo. Price **2/-** net:, postage included.

The Author, in his preface says "It will, I hope be acceptable as a war souvenir to all ranks who served in the 20th Divisional Artillery: the R.A. Charities have been promised all profits that may result from the sale of this book, so I hope that all who can will buy a copy."

Practical Field Artillery Training Notes.

By Major F. E. Spencer, D.S.O., M.C., R.G.A., (Acting Lieut.-Colonel, R.F.A.)

Part II. Gunnery. Price **2/-** net., postage included.

Consisting of 90pp., illustrated by 49 diagrams. Size 4½ by 5¼. This work is uniform with Part I ("Training and Tactics") by the same author, published by the R.A. Institution in 1919, price 1/9d. net., postage included. They are both printed in a convenient form for carrying in the Service Dress Pocket.

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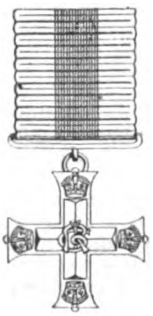

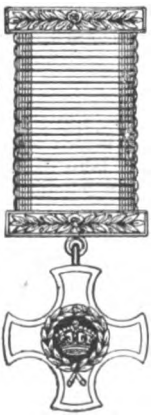

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"DUNCAN" SILVER MEDAL ESSAY, 1919-20.

"The Reorganisation of the Royal Regiment of Artillery with a view to obtaining in war the best value from modern equipments with a minimum of expenditure of human energy."

BY MAJOR S. R. WASON, M.C., R.F.A.

" . . . . MUTARE SPERNO." (?).

ARRANGEMENT.

The situation examined.

- The reason why Re-organisation is suggested at the present time.
- The objects of Re-organisation of the Regiment.
- Factors in Re-organisation.
- The Re-organisation of the post-war Army.
- The ideal to be aimed at.

A scheme for Re-organisation suggested.

- A common basis of training.
- The classification of natures of artillery into groups.
- The division of the Regiment into command artilleries.
- Command and units in suggested re-organisation.
- Training of officers.
- Training of other ranks.
- Equipment and technical training.

Conclusion.

THE SITUATION EXAMINED.

The reasons why Reorganisation is suggested.

Before the war the artillery of the standing army consisted of a large number of horse and field batteries armed with light guns and howitzers, a large coast defence artillery, and a small number of batteries armed with mountain guns and with heavy field guns. At the end of the war, the number of siege batteries armed with medium and heavy howitzers, together with the heavy batteries, approached the number of horse and field batteries; in addition there were a large number of anti-aircraft batteries, of trench mortar batteries and of heavy guns on railway mountings.

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This expansion took place piecemeal and under the stress of war; it was a time for action, not for mature consideration, and, under the circumstances, it could not reasonably be expected that the best organisation would be arrived at.

The conditions as they existed before the war can never return. The importance of the medium howitzer and of anti-aircraft artillery is more likely to increase than to diminish. It seems probable that survey groups and balloon sections will become part of the artillery organisation.

If the question why Reorganisation is demanded at the present time, can be answered definitely, the lines on which Reorganisation should be directed will be indicated.

Reorganisation is required in order that a place may be found for those natures of artillery which developed so greatly in the late war.

The pre-war system failed inevitably to produce sufficient artillery commanders and artillery staff officers, having an equal understanding of the necessities and limitations of all the various natures of artillery with which they had to deal.

The birth of the Air Service, the new part taken in warfare by gas and smoke tactics, the possibilities of survey in war and of other developments of science, combined with the existence of two entirely separate artillery groups produce such complication of organisation and command that the co-operation of the various services and arms has become increasingly difficult.

The war that is just over has shown that the needs and training of the two main branches of the Regiment are now very similar, and has in effect fuzed them into one; many officers of the R.G.A., have served continuously with Field artillery, and R.F.A. officers have also commanded siege batteries with success. It looks as if the dividing line is incorrectly placed, even if it is required at all.

The British Army must always be ready to fight in a great variety of countries; the equipments evolved by five years of war on the Western Front are more numerous than would be required in any one kind of warfare, and it is impossible to expect the upkeep of units armed with all these different equipments. But it would be a great fault, for example, to send an army to fight in a hilly country with the same guns that would be required in a war in Flanders, when more suitable equipment is available.

The needs of the moment, varying with the conditions of warfare, made interchangeability of officers, and even of men, a necessity, and the circumstances of the next war may not present either the facilities or the time available in the war that is just over.

Far-reaching new departures in artillery material were made in the late war, and the certainty of future developments indicates the avoidance of a too rigid organisation.

If a rigid organisation is adhered to, it is difficult to adapt training to altered conditions. If on the other hand, a more general organisation could be found, it might be possible to create a Regiment of gunners formed into units and perfected with one equipment, but so educated that their training would serve equally well with any other.

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The objects of Reorganisation.

Until the year 1901, all the officers of the Royal Regiment of Artillery were to be found together in the Army List according to seniority. At that time by far the greater part of the personnel of the Regiment were serving either in a horse or field artillery trained for quickly moving warfare only, or in a coast defence artillery with a fixed armament. The unrestricted development of two such highly specialized natures of artillery in a long service regular army led them far apart, and the decision to divide the Regiment was only treating the case, as it then stood, on its merits.

Modifications in Naval tactics have altered the problems of coast defence and perhaps minimised its importance; and, in a future war, a great proportion of the personnel will find themselves in neither of these two branches. The first object of reorganisation must be to adjust the organisation of the Regiment to assimilate the newly developed natures of artillery.

The second object of reorganisation must be to provide an interchangeable personnel, trained to use such armament as the conditions of warfare may indicate; the artillery commanders required will be produced by a training of this nature. The state of division of the Regiment in 1914 narrowed the outlook of both branches then existing; the complete separation of these two branches, each living entirely in its own world, rendered their combination in time of war difficult, and matters would be far worse if, in place of two, there were five or six completely separated branches. Over specialization in the various branches of the Regiment by the bulk of its officers is undesirable.

The third object of reorganisation must be to bring the artillery into closer touch with the rest of the army. Artillery exists to help the other arms, and it may not be out of place here to remark on the anomaly of the infantry being other than the senior arm of the Service. The private soldier and his spirit wins wars; there are many more such soldiers in the infantry than in any other arm; therefore all other arms are subsidiary. The technical advances in modern war must not be allowed to obscure this fact. To every measure a counter-measure is produced; make a tank and a gun will be devised to stop it; introduce a new gas and a mask will be found to give protection against it.

In the late war the battery commanders of field and siege batteries were drawn from all classes of civilian life; and these officers commanded their batteries uniformly well even under the very difficult circumstances attendant on the enormous expansion of the army simultaneous with great developments in artillery material and fire tactics. This should surely deny the conviction, prevalent in the other arms, that gunnery is a kind of "black art." Prince Kraft speaks of this veil of mystery as the bugbear of artillery co-operation in 1870, and this has certainly been so in the late war. Must it not be conceded that the sub-division of the Regiment into specialised groups would favour the popular belief of the abstruseness of all artillery matters? If so, the converse is the case, and the amalgamation of all branches would bring the Regiment into closer touch with the rest of the Army.

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The Reorganisation of the post war Army.

Consideration of the organisation of one branch of the service is inseparable from that of the form the Army as a whole will ultimately assume, and the word ultimately is used advisedly.

The present needs of this country in the way of armed forces are altogether different from its future needs, and it is on the latter that such a lasting thing as the organisation of the artillery must be based. There is serious unrest at the present moment and it must be expected to continue for some time; considerable forces under arms must be available to deal with eventualities. On the other hand, war on a really large scale is very unlikely at the present juncture, and, even so, large numbers of trained men would be available in case of national emergency.

In ten years, and to a greater degree in twenty years time, the needs of the country will probably have changed entirely.

Presuming that history repeats itself and that the unrest which has always followed great wars will have subsided, a large force continually under arms will no longer be necessary. But the reserve of trained non-commissioned officers and men at present available will have faded; the junior regimental officers who helped so much to win this war will have grown old.

It must be recognized that the nature of war has evolved throughout all ages in consonance with the conditions of life of individuals and of nations. The primeval man lived alongside his brother, worked with him and hunted with him, and, when they fell out, clubbed him. The tribal system developed out of the family system; wars were next waged between paid armies of nations while these nations looked on. War then became an affair of armed nations, and now of groups of armed nations. So long as possibility of war exists a nation will require first, a huge reserve of personnel ready in body and in will to defend their country and their rights if called on to do so, and, secondly, a nucleus of highly trained officers and non-commissioned officers to teach them and to lead them.

The future requirement of the country, then, is a small highly trained army with an undue proportion of officers and non-commissioned officers to act as a nursery for the personnel of those imperial forces which will carry out minor campaigns, and as nucleus and training staff for the national army should the nation ever be called upon to fight for its life; it must be clearly understood that the expenditure of this valuable material before the act of expansion, by sending it to fight as an army in a war on a large scale, would be criminal folly.

The organisation of the artillery suggested later is based on the assumption that the post-war regular forces will take some such form as that outlined above.

Factors in Reorganisation.

The reasons already advanced are considered to be in favour of Reorganization. Before making radical changes, however, the reason for each change must be examined, and too much stress must not be laid on the experiences of one war—still less on those of one

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phase of war. Preparation must be made for a war that may come, not for a war that is past.

But if changes are obviously required, there must be no hesitation in making them, and the present is an opportune moment for the reason that the conditions of training during the war made uniformity impossible, and some reorganization, at all events of training, is a necessity. An example of this was provided at a conference of gunnery instructors at the Horse Guards in June 1919, where the differences of opinion between the representatives of the siege and heavy artillery schools were greater than those between the field artillery and either of the other branches.

It is worthy of notice that the seemingly most radical changes, are often forgotten in the shortest time. A gunner general discussing the advisability of radical changes, recalled the horror with which the officers of the Regiment greeted the innovation of the section commander dismounting when in action, even though his horse and horseholder still stood "at attention," facing the enemy, exactly five yards in rear.

It is now generally realized that the army is a necessary part of national life; and just as the country demands that the Board of Trade shall carry out its legitimate functions thoroughly but economically, so the War Office must expect, and welcome, the active interest of the nation. The army must no longer be the playground of sections of the community, but a very live department in the national organization.

No scheme, therefore, can be contemplated which is based solely on military considerations. The pressing need for economy must be recognized. It must be remembered that definite results in the right direction actually obtained are worth far more than the prettiest schemes merely discussed.

But for the great necessity for economy, the question of rearming the artillery, certainly of the field army, would have to be reviewed. The tendency for the characteristic differences between guns and howitzers to disappear, and the insistent demands of many officers of great experience for the abolition of shrapnel—the chief justification for the existence of the field gun—point to the possibility of attaining simplicity in equipment and efficiency by the adoption of one equipment each for pack, field, medium and heavy artillery, each using several charges and perhaps some special type of shell for use at long ranges. But the cost of new equipments vetoes their introduction even if it was in every other way desirable.

Again sound arguments can be advanced in favour of a reorganization of brigades and batteries, certainly in field artillery. Two eight-gun batteries, commanded by a major and equipped to fight normally as four-gun units commanded by captains, would form a brigade which would prove a very flexible organization in war. A four-gun Q.F. battery is the largest fire unit the average battery commander can control in observed shooting, but in position warfare a fire unit of eight guns could often be advantageously controlled by one commander. The latter effect might also be obtained by the formation of a pool of guns for each corps or each division for the

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purpose of increasing the number of guns in each fire unit when a period of position warfare is reached.

Great complication of the officer question stands in the way of such reorganization, and in any case the detailed discussion of this problem is outside the subject of reorganization of the Regiment as a whole. The officer question, however, is difficult and cannot be overlooked. The officer has been induced to look upon the army as a profession by the raising of his pay and prospects; if promises, virtually if not actually made, are broken, the class of officer who entered the service attracted to some extent by the guarantee of employment will be lost to the army, and as it is unlikely that the class who are independent of regard for pay and employment will ever again produce the number of officers required, it is in the interests of the State as well as the officer that he should receive consideration.

Two arguments already stated in favour of reorganization are the complication of command that results from the different natures of artillery forming isolated groups, and the necessity for some degree of interchangeability of personnel. On the other hand, a grasp of the technicalities of all natures, whether in equipment, in tactics or in transport is beyond any individual, and this is the strongest argument in favour of such a reorganization as the formation of each nature of artillery into as hard-and-fast a division of the Regiment as the Field and Garrison Artilleries of 1914. The guns range from the gigantic flat trajectory gun for coast defence, or as used on a railway mounting in the field, to the mobile trench mortar or anti-tank gun; their transport varies from railway trucks, tractors, light and heavy draught horses, to pack mules and even hand carts; some are designed to fire at aeroplanes moving through the air at speeds up to 120 miles an hour in three dimensions, others to deal with ships moving at speeds up to forty knots in two dimensions only, others to engage targets on land which, though for the most part stationary, are usually, unlike the aeroplane or ship, unseen by the artillery man. More than a superficial acquaintance with all these problems cannot be demanded of the individual.

But against this is set the argument that a high degree of specialization in anything drives men into a groove, narrows their outlook and limits their usefulness, their readiness to co-operate with others, and their power to adapt themselves to altered circumstances.

The visionaries conjure up dreams of future war where trenches will not exist, in which armies will sally out from their bases as in naval war, in battleship-all-big-gun-tanks, in destroyer-like light unarmoured tanks, in tanks that can fly and even swim; but without overstepping the limits of practical possibilities, it has been suggested by some that coast defence could be best ensured by heavy guns on railway mountings, and a light automatic gun to shoot down the motor-scooter that will soon be able to fly over the boom and torpedo the battleship in harbour. Now railway guns have been much used in the field, and a light gun of some kind will undoubtedly be required to deal with the high speed tank. Coast defence and land defence are not so far apart.

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The technicalities of the different equipments present very striking likenesses, and suggestions will be made to increase their similarity. In the present state of the sciences of gunnery and gun construction, there is no essential difference in shooting at a target at one thousand or twenty thousand yards range so long as it can be seen; even in the case of the difficulty introduced by a third dimension, in shooting at an aeroplane, this difficulty has always been taken into account in accurate gunnery on land, while the method of dealing with the aeroplane's speed is not dissimilar to that used against a ship

The gunnery of a predicted shoot by a trench mortar at three hundred yards range and by a railway gun at 30,000 is the same, and the range tables of all equipments may be made to take the same form.

The rules for the care of the equipment of a 3-pr. Hotchkiss and a 15-inch howitzer vary in number with the size of the equipment but not in nature, and it is as important that the sights of one as of the other should be correctly adjusted. All equipments require a high standard of gun drill whether the number of the detachment is two or twenty, and the processes of loading, laying and firing the gun are common to all.

The question of horse management is one of the chief stumbling blocks, and the answer to this is frequently given that before long the horse will have been replaced by motor transport even in light artillery. This answer is not considered valid; until a tractor has been made of the type required to move field artillery at speed on roads and across country as well as a team of six horses, and a general demand found for it in civilian life, it cannot be expected that a sufficient supply of these will be forthcoming at the commencement of the next war. There is another answer to the tractor versus horse argument, and that is that whereas horses can live on the country, at all events in the beginning of a campaign and particularly in the summer when campaigns are usually fought, all mechanical forms of transport are dependent on supplies of spirit, and the supplies required would have to be very large. It seems safe to conclude that, at all events as far ahead as can be seen, horses will remain in general use in civilian life, and consequently will be available for use in war; and in the next war the army will be more than ever dependent on the available resources of peaceful occupations.

The care of the horse is undoubtedly of primary importance to the efficiency of horse-drawn artillery; but it is believed by many that horse management in peace or war is more a matter of obedience to certain simple rules, which is discipline, than of great knowledge.

A cavalry officer in France was commanding an infantry brigade and was justly proud of his transport horses; on promotion to command a cavalry division he took all his officers as part of their training to see those horses, and note the system under which they reached such efficiency; what proportion of the knowledge and experience of the officers and men of those cavalry regiments could have been found among the transport officers and drivers of a second line New Army division?

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Trained specialists in the way of veterinary officers and farriers are provided in horse-drawn artillery, just as mechanics are allowed for in mechanically drawn artillery.

The tactics of the different natures of artillery is a more difficult problem, but here the fact that the quick development of modern resources in equipment and means of transport makes a high state of rigid training in the known tactics of any one weapon at any one phase almost a drawback in its narrowing influence, is an argument against specialization. It is probable that the more general part of the artilleryman's tactical training in peace time will always be of greater value to him in war than the specialized tactical training in the handling of an individual weapon. As instances of this was the time spent in practising the action of R.H.A. in shock tactics before the war justified by the amount these tactics were put into practice? Was the high standard of training in the occupation of open positions, and in the use of direct laying of much value to field artillery?

Granted discipline—the discipline of an army is the spirit of the individual soldiers organized for war—technical training in the handling of one equipment is a small thing; the means of transport must be understood and well looked after, but surely it can't be the crux of the matter. Men and their discipline make famous armies, not their guns nor yet their horses.

There remains another, perhaps accidental factor, standing in the way of separate organizations of the different natures of artillery. The proportion of siege artillery which seems likely to be kept up in peace time is not great, and the amount of money and personnel allotted to some other natures will be very small. If personnel trained in any way is to be available to man these, the greater part of its training will have to be done in field artillery.

The ideal to be aimed at.

The largest question in reorganisation is undoubtedly that of amalgamation of the two existing branches of the Regiment, or of further sub-division. The present position is untenable; if it remains, to which branch will anti-aircraft artillery belong? And why should pack artillery, the field artillery of hill or bush fighting, belong to the group of the heavier natures?

The arguments appear to be overwhelmingly in favour of one regiment, and on that foundation, then, is this ideal reorganisation built.

The units of the standing army must have a personnel so highly trained that every non-commissioned officer is a qualified instructor, and that a high proportion of the remaining rank and file are embryo non-commissioned officers. The training of the men must be so general, and the equipments so adapted, that training with one equipment will go a long way towards teaching them to use any other. The training of the officers, and the methods of employment of the various natures of artillery taught, must be such that the fighting of other equipments is as easy as the fighting of their own. The system of training of the whole must be so general as to foster adaptability to altered conditions in every officer and in every man,

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while at the same time the methods of their own equipment must be their second nature. All ranks must be imbued with the immortal traditions of the Regiment, but they must be good soldiers of the Empire first, and good gunners afterwards.

A SUGGESTED REORGANIZATION.

The aim of reorganization must be to gain the advantage of an united regiment without the disadvantage that would result from making the system so general that the study of individual branches and equipments might be neglected.

There should therefore be only one Regiment of Artillery in fact as well as name, and the officers and men should be interchangeable between batteries armed with different equipments. To effect this officers and men, and as far as possible units, must be trained on the same basis; at the same time a certain number of officers must be induced to specialise in the different natures of artillery.

A main group should be formed comprising all the usual artillery of the army in the field, pack artillery, horse artillery, field artillery, siege artillery up to 9·2″ howitzers and heavy artillery up to 6-inch guns. Sub-groups of various other natures of artillery should also be formed, one sub-group to be anti-aircraft artillery, others to be trench mortars, coast defence, super-heavy guns and howitzers, anti-tank artillery if it is introduced, and balloon sections and survey sections if they become part of the Regiment.

At the beginning it may be necessary to divide the main group into two parts; this will be discussed later.

In order that there may be that association between officers and men which is so valuable to all ranks in war, command artilleries should be formed; officers and men would then normally remain in the same command throughout their service, whether on transfer to a battery or brigade of a different nature, or on promotion. All units abroad would be affiliated to a command, and obtain their personnel from it; if it should at any time become possible to organize these commands on a genuine territorial basis, great advantages would accrue, especially in the direction of bringing the Regular and Territorial Armies into closer touch with each other.

A common basis of training.

The first step towards this is the use of the same manual by all the different natures of artillery in the main group of equipments; the manuals used by the sub-groups must also be based on, and similar in arrangement to that used by the main group; on many subjects, particularly drill, the same manual can be used by all. The organization of units and of command, and the division of responsibilities among the officers, are other cases in which the introduction of similarity between the various groups would help the officer on transfer from one unit to another.

It is not only among the various natures of artillery that a common basis of training is required. As a result of training in a very limited sphere, the value of standardization of methods of training, of organization and in fire tactics was formerly not appre-

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ciated. The field artillery battery expected to go to war, and to fight throughout that war, without many changes of personnel except those due to casualties; the individual likewise expected to see the majority of his active service in the same unit.

There was a time when a field gunner shuddered at the idea of passing from a field gun to a field howitzer battery; and, when discussing the shortcomings of his battery commander in September 1914, a 60-pr. section commander was heard to say, "But then, of course, old P—— is a mountain gunner." With a certainty that in a war in Europe the army must undergo enormous expansion on the outbreak of war, and that units will have to send their officers and non-commissioned officers to assist in this expansion, the necessity for standardization in units armed with the same weapon is apparent to all. But standardization must go further if interchangeability is to be possible, and experience in training towards the end of the late war went to show that efficiency does not suffer as a result of standardization of methods in use with various equipments.

The classification of natures of artillery into groups

It has been stated that the division of the main group into two parts as a temporary measure would probably be necessary. The object of this would be to allow the gradual dilution of the present Field Artillery with officers from the Garrison Artillery and *vice versa*, until the two original branches would have completely merged into one. This dilution would take place according to a plan of which the main feature would be that each officer would compulsorily spend a part of his service in each division of the main group.

Officers would pass by selection into sub-groups to keep these up to their establishment, but as far as possible within the same command. Service in the sub-groups would have to be made attractive financially or otherwise, as if officers continually had to be detailed, the efficiency of the sub-groups would suffer.

The division of the Regiment into command artilleries.

The division of the Regiment into command artilleries is a means of ensuring that the same officers are associated during a considerable part of their service, that the officers get to know and become known to their non-commissioned officers and men, and of fostering tradition. It has always been a great disadvantage, from the points of view both of efficiency and of regimental life, that the same officers who serve together in a battery and make it efficient, rarely find themselves in the same unit again throughout their whole service; perhaps the loss of the association between the officers and the non-commissioned officers, which is such an asset to an infantry regiment, is a still greater disadvantge. These difficulties would be intensified if a system of compulsory transfer from one group of equipments to another were introduced without special provision to overcome them.

The continual fluctuation in numbers and the formation of four battery brigades have removed what hope there might have been of preserving a brigade or battery tradition in Field Artillery, and this

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is greatly accentuated in the case of siege batteries. The only real battery tradition that remains is in Horse Artillery, and this has been shaken by the reduction of many of the oldest batteries. The most valuable tradition in the artillery, then, is regimental, and every gunner should be proud of belonging to The Royal Regiment. But if it should become possible to organize the artillery of the Regular Army on a territorial basis, a true tradition would be fostered which would not only help the Regiment itself, but also in its dealings with the rest of the army. It must have been remarked by many who had experience of both the New Army and Territorial batteries in the war, that the Territorials had a very real advantage that was not entirely due to the fact that they were of rather longer standing.

It would become a rule that an officer returning from doing duty with a sub-group would go back to his original unit, and the association of the officer with the non-commissioned officers and the men would thus be considerably longer than under pre-war conditions.

Command and units in suggested Reorganization.

The suggested Reorganisation must now be considered in detail as it affects command and units, officers, men and technical training.

It has already been pointed out that while the units of the regular army in this country will be available to form an expeditionary force in a minor campaign, they must be regarded chiefly as a nursery for the forces that must be kept abroad, and as a nucleus round which to form a national army if required. It therefore seems necessary that these units should be distributed throughout the country so as to be available to assist in the training of the Territorial Army, and also that they should be so grouped that the headquarters which administer them and conduct their training, will also be able to deal with the needs of the national army in the same area. Such organization is outside the scope of the question; whatever form it may take, however, all troops serving abroad should be definitely affiliated to and drawn from commands, and artillery units of all the sub-groups before mentioned should be allotted to each command. This should make it possible to put the theory of interchange of personnel within commands into practice.

Owing to such difficulties as barrack accommodation it would often be impossible for all the artillery of a command to be actually stationed within its territorial area; but this must not be allowed to interfere with the combined training of command artilleries, or with interchange of personnel between the permanent staff of the Territorial Army and the regular forces belonging to the same command.

It may seem that the creation of these "command artilleries" would tend to produce "watertight compartments," and prejudice standardized training, but it must be the aim of the inspection service and of educational establishments to prevent this. At the same time little harm would be done by the artilleries of various commands being to some extent alienated from each other if, as seems likely, they were thereby drawn closer to the other branches of the Service represented in their own commands.

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It is essential that standardized methods should be insisted on, and this should be the chief function of the Inspector General's Department, or of whatever takes its place. Without entering into the question as to the form the higher command of the artillery should take, the necessity for some controlling authority, if only for the purpose of co-ordinating Training, must be impressed. If the object of doing away with the Inspector General is to bring the different arms together by keeping them under the same controlling authority, the opinion is submitted that it will fail, but its failure will be more certain if any form of reorganization, which inevitably involves many technical questions, is ordered.

One of the controlling authority's most important tasks will be to supervise the educational establishments such as the R.M.A., the depôts, and the central schools for instruction in shooting, gunnery, riding and driving, signalling and mechanical transport. It may be found convenient and even advisable, for batteries to fire their annual practice at a school outside their own command, where they will profit from contact with and competition against the artilleries of other commands.

The training of an officer.

The outstanding difficulty of a united regiment of artillery is that of training its officers to fight so many different equipments. In order that the best results may be obtained, suitable officers must not only be given a chance to specialize but must be encouraged to do so, while at the same time the bulk of the officers of the Regiment will be of more value in war if they are prepared to deal with any of three different equipments, than if they were all specialists in one only.

The foundation of the officer's military education is laid at the R.M.A., and it is of the greatest importance that the course of instruction there should be so framed that the cadet on leaving will have absorbed all the technical and theoretical knowledge required to carry him through the first few years of his regimental life, when he will be fully occupied in learning the practical use of this knowledge and the duties of an officer in relation to his men. In view of the extension of applied artillery science it is too much to ask that the cadet who is to become a sapper should learn all that the gunner cadet must know, and *vice versa*; it should therefore be arranged that gunner and sapper cadets are separated either at the beginning or after a part of the course; there is no reason why they should not work together in other than artillery and engineering subjects. In the same way the cadets' time should not be too much occupied with mathematics or other subjects which should have been taught at school, or with classroom instruction in foreign languages. Their military education should be very general, and their education in technical and artillery matters should aim at showing not how abstruse gunnery is, but how easy the subject is if properly taught.

The young officer should join the service with a sound general knowledge of artillery subjects; it is of the greatest importance that, at the commencement of his service, his education should be progressive and uninterrupted, gradual and not in any way hurried.

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Technical knowledge can be crammed, but time is required to gain practical experience and knowledge of how to handle men. The young officer should therefore serve his first three years continuously in the same unit of the main group of the Regiment, and this should be a probationary period. He should then join a unit of the main group armed with a different equipment before the "individual training" season and serve one full year uninterrupted by absence on courses, etc.; he should then be fit to serve in any of the equipments of the main group if required, and should be encouraged to join a sub-group for a year. At the end of this time he should undergo an examination for promotion, and officers who do not elect to do a year with a sub-group should be compelled to take up an alternative subject such as a language. The subaltern would then have five years' service, have served with either two or three different equipments, and should be allowed to remain in, and specialize in the sub-group in which he finds himself, or to return to the main group. Subsequently on promotion he should go back from the sub-group in which he has been serving to a main group unit, or from one main group unit to another differently armed, for a period of two years and pass an examination for promotion on both equipments with which he serves.

In order that the changes involved may not prevent officers getting to know their men and each other, they should, whenever possible, return to their original brigades or even batteries, and, while promotion should be on a general list throughout the Regiment, officers within two years of promotion should be allowed to hold the next higher acting rank so as to enable them to fill vacancies in the units to which they originally belonged.

Training of men.

That part of the suggested scheme which deals with the training of "other ranks" must aim at producing first a personnel fit to man any equipment of the main group with a very small amount of additional training, and secondly, a disproportionate number of non-commissioned officer instructors; how these may be obtained will be best shown by outlining the career of the man from the day he joins the service.

The recruit should be given a general education at the Depôt—that is to say, he should be taught the rudiments of at least two equipments and their gun drills, in addition to the other usual exercises required of the young soldier. In order that units may not be reduced in strength below the peace establishments, which for reasons of finance are certain to be low, the number of recruits at the Depôts should on no account come out of the total personnel allowed for the units, and indeed training would be greatly facilitated if squads of recruits could be posted to brigades before they were required to fill vacancies; their training with that equipment with which they were to serve could then be carried out under brigade arrangements, and they would join their batteries really trained. Supposing that the pre-war system of progressive training, beginning with individual training in the autumn, is to continue, it would be convenient that recruits should join in the late summer

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so that they might have the advantage of the complete year's training, but it is recognised that this is ideal and could not often be done under a voluntary system.

From the very commencement, inducement, financial and otherwise, must be held out to soldiers to become non-commissioned officers and instructors. The first year with the unit must be unbroken by absence on courses, but as soon as it has been completed the promising recruit should do a non-commissioned officer's course away from his unit; it is undoubtedly difficult for men to acquire the self-confidence and power of command required of the non-commissioned officer while among the companions with whom he has served from the day he joined the service.

Terms of service should be so adjusted that it will pay the promising soldier or non-commissioned officer to continue in the service at all events long enough to reach the rank of corporal, and to become a really efficient instructor, for which age and experience, and hence length of service, are almost necessities, but the non-commissioned officer who has reached a certain age becomes unadaptable, and, unless he has reached high rank, is not worth retaining and prevents the promotion of younger and keener men. Similarly the inducement of promotion to commissioned rank should be offered to young non-commissioned officers, but in war or in peace the granting of permanent commissions to non-commissioned officers over the age of twenty-five is a mistake in that they find themselves at a great disadvantage as regards age and service with the officers who are commissioned from the R.M.A.

Non-commissioned officers should pass automatically in a fixed proportion from units armed with one equipment to others within the same command, and accelerated promotion should be given to those who do so, and who make themselves efficient. In the individual training season gun drill with different natures should be taught, and opportunity should also be given to all ranks to watch the drill of batteries armed with different equipments.

Equipment and technical training.

In matters of technical training and material it might appear at first sight that each nature of equipment should be treated on its merits; but if this were done, the difficulty of learning different equipments would be greatly enhanced, and an interchangeable personnel could hardly be obtained. For this reason it is necessary to standardize the methods and material in use with each equipment as much as possible, and the slight loss in efficiency entailed by inability to exploit to the full the peculiarities of individual equipments, would be more than compensated for by the increased readiness with which they would be learnt. This has been done to a great extent during the war; for example the No. 7 Dial Sight without a lower deflection scale is in use with nearly all equipments for laying guns indirect; again the range tables of most guns now take the same form. Two factors affecting standardization must, however, be kept in mind; first, at present it is useless to advocate changes in equipment entailing much expense; secondly, the advantages of wholesale changes in methods or material are often

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counterbalanced by the resulting confusion in training. While the latter is of more importance in the case of armies on a short service system with large reserves such as continental conscript armies, it applies to our army so long as the men who fought in the late war are regarded as reserves.

The question arises as to how much of the subjects of gunnery, ammunition and gun construction shall be taught, and how much their requirements shall be satisfied by the construction of the individual equipment, and by the orders given for its use, is a very contentious one.

If the officers of the regular army only were concerned, it might be possible to get the best results by a combination of simplicity of equipment and complete knowledge on the part of the officers concerned. But if one of the chief functions of the regular army is to provide a nucleus for a national army, the case is altogether different in that it cannot be expected that the officers of the latter will reach the same standard of technical knowledge. With the facts learnt and the experience gained during the late war, equipments can be designed, and orders for their use formulated, which require very little knowledge of gunnery on the part of the battery commander and his officers and men, and if this is done, even in the case of officers having greater knowledge of gunnery, the best value will be obtained in stress of battle in the shortest time and with the least expenditure of energy. It may be asked, why then should time and energy be spent on teaching regimental officers gunnery at all? But to this there are two answers either of which by itself would suffice. Though it may not be absolutely necessary, a man who understands thoroughly the theory as well as the practice of the instrument he uses, will always prove superior to another lacking such knowledge, and the interchange between equipments will be much easier to him. Again it is from the ranks of the regular officers that instructors and specialists in gunnery and gun construction must be obtained and, in view of the great dilution of the regular army in time of war, as large a number of officers as possible must be encouraged to take up these subjects keenly. An efficient instructor must always know a great deal more about his subject than those he is going to teach.

Methods of training and construction and provision of material must aim, then, at simplifying the use of equipments by the officers of a national army. The policy must be to give definite orders rather than to let the individual find out things by his own experience. Slide rules and other automatic appliances are of great assistance so long as their use is foolproof.

The rule that suggestions should not entail expense must be relaxed in this case. Equipments and their use developed on different lines during the war and effects to bring them together necessitate modification in the equipments themselves. For example, fuze indicators are required for all guns firing shrapnel; calibrating sights are required for all guns, and if this is not possible gun rules should be provided for the exceptions. Again all guns should be given elevation according to the same standard, either in yards, minutes, or degrees and minutes. The ammunition to be

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used should be carefully considered, and as many of the different patterns eliminated as possible; one pattern of driving band only should be used with each equipment, and the variations in weight of shells reduced. All these things would help to bring equipments together and hence to make interchangeability of personnel possible.

Questions of technical training and material cannot easily be dissociated; they may be considered as they affect first, the officer, and secondly, the rank and file.

The basis of the artillery officer's training before the war was the section commander system, and this has proved its value to such an extent that its application should be extended; the sense of responsibility, power of command and self-reliance developed have been of great value to the Regiment and to the Service.

The standardization of officers' training will be greatly helped by the common use of one manual. A common footdrill, and a common procedure for the occupation of positions and for the establishment of communications, will remove many of the difficulties which might arise in drill. The same gunnery training and range tables of a similar nature will be of corresponding value to battery commanders and others in shooting different natures of guns, and a common fire discipline in such things as the meaning of orders and the methods of giving them, and also the methods of carrying out so-called map or "predicted" shooting, will also be of great assistance. A standardized and self-explanatory nomenclature is one of the first essentials. It will simplify the giving and understanding of instructions and the learning of different equipments and gun drills; to give an instance, range indicators graduated in yards, if such are to remain, should nevertheless be called elevation indicators, as, strictly speaking, this is more accurate, and would agree with the elevation indicator of those guns in which elevation is always given in degrees.

The most important thing in training of other ranks is standardization of gun drills. The first step is to make the section gun drill of different equipments as similar as possible; nomenclature again is important and similar wording even in detail should be used whenever possible. The names of similar parts of different equipments should be standardized and simplified wherever possible; an instance of this is the use of the terms "calibrating sights," "muzzle velocity correctors" and "gun rules," all of which effect the same object in more or less the same way, and for which one expression might easily be used. The term "corrector" should be reserved for fuze indicators, and fuze indicators should be provided for all equipments using shrapnel, in order to avoid the complications of calculation of fuze length by the officer, and the necessity for application of corrections to fuze length by the No. 1.

It might be possible to arrange the actual numbers of the detachments so that even numbers always worked on the right and odd numbers on the left of the trail, or so that the layer, trainer and loader had the same numbers in most equipments, but inevitable difficulties arise. Anyone who has learnt different gun drills will, however, realize the value of such details.

Training in laying should follow the same plan in all equipments, and so should methods of laying as far as possible. For instance,

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clinometer laying should not be regarded as the normal method with heavier natures, but for use when the slight possible increase in accuracy is all important; similarly direct laying should be reserved for the most simple and obvious cases with all natures, and such methods as direct laying through the dial sight with field guns should be abolished.

A tight hold on training would have to be kept by the Inspector General's Staff, and the adoption of unorthodox methods, and even their trial without official permission, would have to be definitely forbidden.

An important technical lesson of the late war is that great results can be obtained from well directed intensive training—contrast the speed with which efficient soldiers were turned out in the opening and closing stages of the war, making due allowance for the falling off in standard of the raw material. Two things are necessary; first, a well considered course of training unbroken by changes of method; he who knows what he wants is a long way towards getting it. Secondly, good instructors; in the army of the future, education is the foundation of success, and the profession of teaching deserves fullest encouragement and the most honourable regard.

CONCLUSION.

What advantages does this suggested Reorganisation claim? That it presents a workable scheme to reconstitute the Regiment in order to obtain the greatest efficiency, without such revolutionary changes that the present great difficulties of training would be unnecessarily increased; to produce an interchangeable artillery personnel, organized into units ready to take the field, or to expand into and train a national army; imbued with a regimental, and perhaps a territorial tradition also, and yet sensible of the duty of artillery to the other arms.

If reorganisation of the Regiment is to begin by the amalgamation of the two existing branches, it must be done with good will. The solidarity of the Regiment must not be disturbed by petty jealousies; extreme opinions which cannot be reconciled must be discountenaced and abandoned. The part that regimental institutions and clubs can play in welding opposing factions is great; and the reorganization of these institutions, and of peace-time regimental life, must be conducted with regard to the help it can contribute to this end.

An efficient army is a nation's insurance policy. A distinguished gunner general has said that the Royal Regiment is a decided asset of the League of Nations, but this cannot be so unless it is united within itself.

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A HISTORY OF ARTILLERY.

PART I.—ARTILLERY BEFORE THE REGIMENT.

By Ralph Flenley.

(University of Manitoba, Winnipeg, Canada).

WHEN the guns of the Royal Regiment of Artillery opened on that misty 1st of July 1916, for the battle of the Somme, the Regiment was celebrating thereby its two hundredth birthday. And British guns had echoed over the fields of Flanders and northern France for nearly six hundred years ere their echoes died away on the morning of 11th November, 1918. The records of the Royal Artillery Institution and the works of Duncan, Hime, May, Leslie, Jocelyn and many another, testify to the continuous interest of the gunner in the history of his Regiment as of artillery in general. Yet there is no easily accessible, concise and up-to-date account where the thousands who now claim kinship with the family of British gunners can read this history. The sketch that follows, may help them to gain some knowledge of the early history of Artillery.

From one point of view, the whole history of the art of war may be regarded as the story of the continuously increasing use and importance of artillery. Not that it has been an evenly continuous growth: there have been periods of stagnation and even of retrogression, when through the development of other arms, the rôle of artillery in war has actually decreased. As late as the nineteenth century it was seriously suggested, that with the introduction of rifled small arms with their increased range and accuracy, artillery would cease to be a decisive factor in war. The reply came of course with the introduction of rifled ordnance with an enhanced rôle for artillery both light and heavy culminating in the terrible achievements of the late war. Gunpowder, guns and gunners—both garrison and field—were in existence as everybody knows long before the Regiment. The creation of this last was simply the organization on a permanent basis of what had been in existence for centuries. It is necessary in this sketch therefore to go back behind the Regiment since not to do so would be as unfair as to make no mention of the artillery driver before his regimentation nearly a century after 1716. The initial difficulty met by anyone venturing to write on the history of artillery is to decide where to begin. Persians, Chinese, Jews, Greeks and Romans all had "artillery." And long after artillery in our sense of the word had appeared, we still find the term including most of the various instruments employed for the projection of missiles in war, from the engines for set sieges used in England as late as the Civil War of the seventeenth century,

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to the long bow. The authorized version of the Bible makes Jonathan give his "artillery"—his bow and arrow—to his servant to carry away. Yet the difficulty is more apparent than real. Whilst modern artillery may be said to trace its descent on one side from the earlier "engines" and on the other from the cross-bows with their quarrels or bolts, we need not look for it behind the mixture of saltpetre, sulphur and charcoal, which made gunpowder. Nor need it give us serious concern that we are unable to say with certainty when and by whom gunpowder was first made, or indeed cannon first employed in war. We can be fairly sure that powder was first known in the second quarter of the 13th century and that Roger Bacon an Englishman was one of the first men to make it. With regard to cannon a claim has been made for a German monk, a Franciscan, as their inventor. We know that the Florentines were making brass cannon by 1326. We are at any rate safe in asserting that cannon in which gunpowder was to be used were first made shortly after 1300 on the continent and that they quickly became known in Italy, Germany, France, the Netherlands and England.

It is in part the result of the vague and wide use of the term artillery that we are unable to say precisely when cannon were first used by English kings. Colonel Hime is of opinion that our earliest cannon were imported from Ghent in 1314 within a year of the date he gives for their first manufacture. That may be a little early but is not of course impossible. It is often asserted that we first used artillery in the expedition of Edward III against Scotland in 1327, on the authority of Barbour the Scottish chronicler. But Barbour wrote long after the expedition and no other chronicler mentioned cannon in this connection. Since we find a certain Thomas de Roldeston in charge of the kings engines in 1314 and making powder for some of them, we are fairly safe in assuming that England had some cannon by the time the Hundred Years War with France opened. Their employment in the battle of Crecy is not so certain. None of the English chroniclers record it though two others do. The point is not of cardinal importance. The field gunner of to-day can well afford to leave Crecy what it has always been *par excellence*, the day of the English archer. There is less doubt of the use of cannon in the Siege operations of this same year 1346. An early ballad tells us of the siege of Calais that—

> Gunners to shew their art
> Into the town in many a part
> Shot many a full great stone.
> Thanked be God and Mary mild
> They hurt neither man woman nor child
> To the houses though they did great harm.

And as the war dragged on its slow length we find increasing reference to guns and gunners. We find record of the payment of gunners for siege work. We find Master gunners, for example at Calais shortly after its capture. Records of the royal stores contain notices of guns, powder, etc., and of payments connected therewith. Calais had fifteen guns in 1369, Dover three years later had six, the Tower about the same time had twenty-nine iron and

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twelve brass cannon in store. It was in fact by this time the proper and recognised thing for mediæval fortresses to have cannon in store or mounted for defensive purposes, as it was for besiegers to use them for siege work. There are still lying at Mont St. Michel in Brittany two enormous bombards abandoned after an unsuccessful siege by the English in 1423. It is soothing to national feeling to find French guns, albeit small and of Napoleonic times, on the battlements of the English counterpart St. Michael's Mount. Harfleur we are told by the historian of the British army was 'the first town England had reduced by the fire of cannon.' This was in 1415. The chroniclers tell us however that ten years earlier Berwick had surrendered to English arms after the first discharge from a cannon had shattered one of its towers.

That is stepping into the next century, the fifteenth. This century saw artillery as an essential factor in the sieges which form so notable a feature of its military history, the most famous being that of Constantinople which took place in the very year that the Hundred Years' War came to an end. In the majority of cases the introduction of cannon favoured the besiegers rather than the besieged since the average mediæval town or castle wall was not wide enough, often not strong enough for the heavy bombards of the day. For with the growing appreciation of artillery we find a great increase in the size and weight of siege cannon, to dimensions which even to-day may surprise if not amaze us.[1] Cannon or bombards such as these were naturally beyond the reach of private individuals. And though we do hear of cannon being hired out to the king, like ships for war during the same period, for the most part artillery was a kingly possession; it was "royal" from its earliest days. For then as now guns required trained gunners and expensive stores. The growing importance of this arm in England is illustrated by the appearance in this century of a Master of Ordnance. Not that England had any preeminence in artillery over her neighbours; in fact she was rather behind them. She was not making her own cannon so far as we know, but importing them from the rich cities of Flanders, then at the height of their power. There and in Italy with her civic wars, and in France, the development and use of artillery was more marked than in England. The increasing French use of and superiority in that arm was indeed a contributory if minor cause of the ultimate downfall of England in the long war. With the bow the English still reigned supreme, but at Formigny (1450) and at Castillon, the French advantage in artillery was clearly shewn.

[1] The two cannon mentioned above as left at Mont St. Michel were of no less than 14 and 18 ins. calibre. This was not out of the way. "Mons Meg" the well known Scottish piece made some time previous to 1460 had a bore of 20 inches. Ghent produced about the same time a bombard called "The Dulle Griete" of 25 ins. bore, weighing thirteen tons. Of this or some other contemporary Flemish bombard we are told that "it makes so great a noise at discharge that it sounds as if all the devils in Hell were let loose". The devils have increased in number or lung power since then. These were iron cannon. There lies outside the Rotunda at Woolwich a bronze cannon cast by Muhammed II of Turkey in 1464, likewise with a diameter of 25 inches. Other bombards of great size had been used by the Turks against Constantinople shortly before—one of these was said to have had a calibre of 5 feet and to have required 60 oxen and 30 wagons to move it.

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That is not to say that whatever may have been the case at Crecy, cannon played much part in the field warfare of the period. There was no artillery at the battle of Poictiers though the Black Prince had some with his force. Nor was any used at Agincourt sixty years later, in part because of the mud of northern France. The Civil Wars in England which followed the French war saw it is true a little more use of cannon in the field. Edward IV won the battle of Lose Coat Field near Stamford in 1461 almost entirely through his artillery. And likewise at Northampton and late at Barnet and Tewkesbury (1471) we find cannon on the field, though in other battles of the time it was not employed at all. It was in fact mainly a siege weapon as yet in England, and a most useful and potent one in the hands of the Crown in its last struggle with the baronage as both Edward IV and Henry VII realised. The latter, a peace loving man, was yet wise enough to keep a "great store" of cannon in the Tower and to use it when occasion required. For what we may term the beginnings of mobility of field artillery we must look abroad. Zizka, the patriot leader of the Hussites of Bohemia, is said to have "introduced field artillery", a somewhat vague phrase. We know however that he had with him in the field light guns which he transported and used with great effect, when neither his opponents nor anyone else had conceived of such a development. The first use of howitzers is also said to have come in these same Hussite wars. More definite and lasting improvement came in the wars ushered in by the invasion of Italy by Charles VIII of France in 1494. It is in these wars that we first find the wheeled gun carriage in use, and limber and trunnions accompanied or followed it. In the decisive battle of Marignano in 1515 Francis I owed his victory not a little to the artillery he had with him in the field.

The fifteenth century was, as everyone knows, the century of the Renascence and one sees its influence in the artillery developments of the time. The temporary appearance of a breech-loading mortar, the experiment with a pointed projectile centuries before its adoption, an early anticipation of case consisting of a number of small stones in a canister or case, the invention of the serpentine, an early predecessor of the machine gun with many small tubes of small bore to be fired together or in succession, may all be put down to the growing scientific interest of this period, as can the experiments in gun-making as a result of which cast iron and bronze came in the fifteenth century to oust wrought iron very largely. Yet it would be wrong to make too much of all this, particularly so far as England is concerned. Whilst artillery had become by Tudor times a recognised part of the war equipment of the king playing an increasing important part in sieges and influencing the results of battles, we are still a long way from the stage when it could be said that "artillery is everything in sieges and almost everything in field operations." The science of gunnery can scarce be said to have been born yet. Ammunition was for the most part rounded stone balls. Gunpowder was poor and weak. Though its manufacture was improving, the earlier 'serpentine' powder being superseded by 'corned' powder, its strength was "no more than that of the squib

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composition of the present day."[1] The range and effect of artillery fire were of course proportionately limited. Gun casting was far from a perfected process and guns were liable to bust not infrequently. James II of Scotland perished by the bursting of a cannon at the siege of Roxburgh. To its immobility as an argument against its use can be added a certain antipathy toward it as disturbing the older traditional ways of making war. Yet its moral effect was probably never so great. As late as 1425 a chronicler tells us that a whole army flung itself on the ground at the sound of the first discharge of a cannon—a small army and a large cannon we may imagine. Holinshed a patriotic English chronicler, tells us that in one Anglo-Scottish encounter the commander of the English ordnance "caused such a peal to be shot off at them that the Scots fled". Shakespeare makes the Chorus in Henry V recite how before Harfleur

> "the nimble gunner
> With linstock now the devilish cannon touches,
> And down goes all before them."

* * * * * *

In the general development of the art of war in the sixteenth century England was rather behind than in front of her continental neighbours. She had as yet no standing army and she clung to the bow when elsewhere it had been discredited and almost discarded in favour of the musket or arquebus. The Tudors on the whole took full advantage of the moat which served in the office of a wall. And though the century saw rebellions in England, fights with the Scots, disorders in Ireland, expeditions to France, Spain and the Low Countries, to say nothing of threatened invasions from abroad, yet the number of pitched battles fought by English forces on land is surprisingly small. There are no long campaigns such as those of the preceding or succeeding centuries so that we are unable to follow the development of artillery from battle to battle through the century, even had we time. Yet the growth in importance of the arm from the accesion of Henry VIII to the death of his great daughter Elizabeth is unquestionable, and not very difficult to see. It can be argued that the comparative isolation of England from the continent affected artillery development less than it did other arms. For this was the century in which England discovered that she had in her the makings of a sea power. The story does not of course concern us save to note that in the conflicts it inevitably brought with other sea powers, gunners as well as sailors learnt their trade and played their part. If a Master Gunner could declare in 1587 that "Englishmen have had but little instruction (in gunnery) but that they have learned of the Dutchmen and Flemings in the reign of Henry VIII", the following year shewed that they had learnt theirs lesson well enough to play no small part in deciding the fate of the Armada of Spain. And there was of course no hard and fast line between the land and sea service of guns and gunners. The

[1] Col. Hime, *The Origin of Artillery*, 1915; *R.A. Journal* XXXI. (1904-05), p. 489, *seq.*

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same guns from cannon royal to falconet were used for both, the same body, the Ordnance, looked after guns for both. In regard to mobility, it is true naval experience did not help very much: mobility at sea was of ships not of guns. The close connection established however endured for a long time. For a century after its formation the Royal Regiment supplied officers and men for the "bomb ships" of the navy. And though the creation of the Royal Marine Artillery in 1804 severed the formal connection, the land services rendered by naval guns and gunners in the Crimea, in South Africa or in Flanders at least remind us of the old connection.

The matrimonial adventures of Henry VIII have rather overshadowed his other activities, notably his work for the navy and the army. Though his work for the latter is the less important of the two, it must not be passed over here since in the opinion of one well qualified to judge "the arm wherein Henry worked most improvement was undoubtedly the artillery . . . . there remains no doubt that Henry VIII created the British gunner".[1] It is hardly fanciful to suggest that the pomp and circumstance of artillery would appeal to one who had so keen an appreciation of the divinity which hedged him about. On his first and best known expedition to France in 1513 he took with him far the largest and most imposing train of artillery which England had so far put into the field. True the train of 1300 vehicles included in its "artillery" such weapons as slings and bows. Yet it was the cannon and bombards, so the chroniclers tell us, that so "sore beat the walls" of Therouanne that the city surrendered. Likewise in the more famous siege of Tournai in the same year it was the twenty-one pieces of great artillery which caused its surrender in six days. Not less notable, the English culverins of 5½ inches diameter throwing an eighteen pound shot, though siege guns, were turned to play a part in the skirmish called the Battle of the Spurs. Henry's last expedition to France, thirty years later, shows a considerable advance in what we may term the artillery establishment. The artillery, it is worth noting, was divided into two companies of one hundred gunners each commanded by a Master gunner. In addition we find seventy other gunners, artificers etc., carters "for the kings great mares for the train of artillery", an officer "to choose the gunpowder", with the usual clerks and servants for the Master and Lieutenant of the Ordnance and the Master of the Armoury. We may note a similar advance in connection with the two battles with the Scots during these years. At Flodden Field in 1513 the Scots seem to have had the larger train of artillery though the loyal English chroniclers tell us that the English cannon were so much better served that they speedily silenced the Scottish guns. But when Protector Somerset in 1547 led an expedition into Scotland he not only took with him a very considerable train of artillery but what was more used it with great effect at the battle of Pinkie, planting it on the crest of the hill where it could with its fire make such gaps in the line of Scottish Pikemen that the English horse were able to get in and roll them in disorder and defeat down the hill.

In the later years of Henry's reign there was a lively and not altogether groundless fear of invasion in England, in response to

[1] Fortescue. *History of the British Army*, i. 122.

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which we find much attention being given to the condition and armament of the fortresses in the kingdom, particularly those on the south coast. Old forts were repaired and given additional cannon, new ones—forts rather than castles—were built in Kent, Sussex and Hampshire and equipped with guns and gunners against any coast raid or attempt at invasion. From this time onwards we can trace the succesion of gunners in these fortresses, forerunners of the 'Invalid Companies' of the Regiment in the eighteenth century. They were paid 12, 9 or 8 pence a day, on no system that we can perceive, each little group being under its own local Master Gunner. Although "garrison gunners" they were liable to be sent into the field with their guns as occasion arose. It was perhaps in connection with this growing demand for cannon that we first find reference to the making of guns in England on any scale. It was in 1521 so Stow the London tailor tells us that "great brass cannon and culverins were first cast in England." Similarly we learnt that iron pieces were cast at Buxsted in Sussex in 1543. Also in this year according to Stow, the first shells were cast in England for eleven inch mortars, "certain hollow shot of cast iron whereof the bigger sort had screws in them to receive a match and carry fire to break in pieces the same hollow shot, whereof the smallest piece hitting a man would kill or spoil him." But this like other experiments of the time was rather anticipatory. It would be as unfair to the memory of the great Henry as to a body still flourishing if we said nothing of his foundation of the Honourable Artillery Company. The Company was instituted in 1537 by letters patent "to be overseers in the science of artillery to wit for long bows, Cross Bows and Hand Guns." Though its formation was in part due to the desire of the king, in which he was followed by Elizabeth, to maintain the practice of archery, the Company has throughout its history, played a part in the development of artillery in the modern sense of the word, as every one knows, to our own day.

This same king helped to develop the "Board of Ordnance," to use its later name, with which the history of artillery has always been closely connected, not least in the foundation of the Regiment by the then Master General, the first Duke of Marlborough. We have not space nor indeed is it necessary for us to follow the history of the Board from a reference to a 'Master of Ordnance' in the year before Agincourt, past a certain Thomas Vaughan, Esq., Master in 1455 or a certain Ralph Bigod appointed to the office by Richard III to hold office for life, from whose day we can trace the continuous succession of Masters or Masters General down to the day when the last yet not the least of them, Lord Raglan, died whilst commanding the British forces in the Crimea. In decease as in origin the Master General was a soldier. Significant of the growing importance of the department is the appearance in 1518 of a lengthy account of the duties of the Master of the Ordnance when he went forth to war with the king.[1] He was of course responsible for all munitions of war, he was to see the ordnance in battle "planted to the most advantage", to see to the ammunition supply, "and in any case to circumspect that the master gunners do their duties belonging to

[1] Printed in Grose, *Military Antiquities*, 1801 edn. i. 200 *sig.*

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them". We may note one curious privilege out of a host of multifarious duties recorded—the right of the master gunners and gunners to the best bell of any captured town, a right also in vogue in the French armies. Before the close of the century we see added a Lieutenant, later a Lieutenant-General, of Ordnance, a Surveyor General, and an additional Lieutenant, with of course a corresponding increase in the number of clerks and storekeepers. The Master, who becomes the Master-General in 1604 is usually a peer instead of a knight by the end of this sixteenth century, and his emoluments have increased in proportion.

The Master of the Ordnance was sometimes called the Captain General of Artillery in the field at this period. The Master Gunners may be termed the "Captains" of artillery. Those in command of the companies of artillery in 1544 were by no means the first to bear the title of Master Gunner. We have "Masters" of the various mediæval engines of war before our cannon appear at all; the name of one of them, of the 13th century, John de Flemyng, suggests his origin. For three hundred years they, like our guns, seem to have come from Flanders. Calais and the Tower appear to have had Master gunners from the 14th century, and it is reasonable to suppose that most of the other royal fortresses equipped with cannon for defence had by Tudor times a master gunner in charge, with a varying number of gunners under him. His pay at this time varied from two to four shillings a day. It is again to Henry VIII that we must look for the creation of the first "Master Gunner of England," Sir Christopher Morris, who is said to have first held the office. He was a notable gunner, commanding the artillery in expeditions to Scotland and France and being wounded in action. From the latter part of this century we have a fairly clear succession of the Master Gunners of England. Beyond his duties in the field down to 1688, the last year in which he appeared on active service, the Master Gunner was responsible for the training of gunners and their practice in shooting. Thus in 1594 "the master gunner of England taught his scholars to shoot in great ordnance at the artillery garden". The "artillery garden" or "yard" near the Minories, was the recognised place for the training of the Tower gunners at this time. The Master Gunner administered an oath not to serve any foreign prince to all admitted as gunners, and he was responsible for the firing of royal salutes and, for fireworks when these began to be used. His formal duties developed at the expense of his active service ones as time went on, though he could and did command artillery in the field as an artillery officer. The last Master Gunner of England died in 1758. His successors have been Master Gunners of Whitehall and St. James's Park.

It is not necessary to attempt to trace the different occasions in the latter half of the sixteenth century in which artillery was usefully employed. We have arrived at a stage when it may be assumed that a train of artillery would be attached to a force of any size, though we find exceptions as in the case of the first force sent by Elizabeth to the Netherlands, which had no artillery. A expeditionary force of the year 1600 had ten guns to twelve thousand infantry and sixteen hundred horse. Whereas the Cornish rebels of

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Henry VII's reign had no cannon, it is a sign of their increasing commonness to find that the Norfolk rebels of his grandson's day had guns and used them with effect. As the century went on more and more guns were cast of all calibres from "great ordnance" down to what were little more than muskets. A table drawn up in 1574 is worth reproducing as it gives particulars of all or almost all the pieces in use at the time.[1]

	Name	Weight lbs.	Diameter inches.	Weight of shot lbs.	Scores of Carriage.	Charge of Powder lbs.	Height of Bullet inches
1.	Robinet	200	1¼	1	...	½	1
2.	Falconet	500	2	2	14	2	1¼
3.	Falcon	800	2½	2½	16	2½	2¼
4.	Minion	1100	3¼	4½	17	4½	3
5.	Sacre	1500	3½	5	18	5	3¼
6.	Demi-Culverin	3000	4½	9	20	9	4
7.	Culverin	4000	5½	18	25	18	5¼
8.	Demi-Cannon	6000	6½	30	38	28	6½
9.	Cannon	7000	8	60	23	44	7¾
10.	E. Cannon	8000	7	42	20	20	6¾
11.	Basiliske	9000	8¾	60	21	60	8¼

The table agrees well enough with the other evidence we have of the size and weight of the cannon of the period, for there would obviously be slight differences in the same type of cannon. It is very little different from a table drawn up in 1639 save for the inclusion in the latter of a few more types of ordnance. As in our own day no strict line of demarcation can be observed between guns used in the field and those reserved for fortress or siege work. Probably as in the next century guns of the "saker" size and below were regarded as field guns. Range tables we have not as yet. Most artillery work seems to have been done at a range of two or three hundred yards. And though it would be unkind and indeed unfair to deny to Elizabethan gunners on land or sea a practical knowledge of their art, with culverin or saker, iron or stone shot—iron by this time was the more commonly used—yet in artillery work as in science in general we are still in the age of discovery; we have not yet passed into that of Science. Men could still trace in the noise and smoke of the discharge of a cannon something of a Satanic origin.

[1] Printed in Cleveland, *Notes*, p. 19: cf p. 40. Firth, *Cromwell's Army*, p. 402, ? 1639 table.

(To be continued.)

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MOBILE ARTILLERY AND AIRCRAFT.

(Special Prize Commended Essay).

BY CAPT. K. M. LOCH, M.C., R.F.A.

ARTILLERY AND AIRCRAFT.

ONE of the most alarming features of present day life is its ever growing complexity. This complexity has crept into modern warfare in a most bewildering manner, during the flood tide of the last five years. It is almost a truism to say that of all the innovations which have appeared during this period the materialisation of flying as a "fait accompli" is the most far reaching in its effects. The question now presents itself to gunners as to how to evaluate this new factor with respect to their own particular arm. The experience and results obtained during the recent war must be examined with considerable caution, especially when dealing with the anti-aircraft problem. Once the underlying principles of the problem have been evolved a judicious imagination must be brought to bear to adapt them to the probable lines on which future warfare will develop. This imagination should avoid the extremes of conservatism on the one hand and the sensationalism of the military "arriviste" on the other. It is almost certain that in the next war a large national army will have to be evolved out of small professional cadres. Collective humanity is not attuned to the present rate of progress of science. The practical application of science in warfare must therefore be on simple lines capable of easy assimilation by the comparatively untrained mind—"il faut mediterranniser la musique."

The subject of this article resolves itself logically into three main headings:—

(a) Co-operation with aircraft as a means of increasing the offensive power of field artillery.

(b) Passive defence against aircraft i.e., concealment.

(c) Active defence against aircraft i.e., fire effect.

CO-OPERATION OF AIRCRAFT WITH FIELD ARTILLERY.

The advent of flying has among other things increased the offensive power of artillery. It has solved to a considerable extent the problem of the eye which can see behind the hill.

The aeroplane however does not replace the functions of the land observer, but rather amplifies them. The aerial observer enjoys direct and unobstructed vision from a most advantageous position, such as is obtained by no other method.

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If he is to benefit fully by this, the gunner must however accept the necessity of considerable extra training of a somewhat complex and specialised nature. The main principles of co-operation apply equally to all natures of artillery but in actual practice they must be modified to a certain extent when applied to field artillery.

The duties of aircraft co-operating with artillery divide themselves into two main headings.

(a) Intelligence work.
(b) Direction of fire.

Each heading has its particular application to stationary and to mobile warfare.

(a) Intelligence duties as regards co-operation with artillery, imply the location of targets suited to the particular nature of the artillery and distribution of the information to the batteries concerned. This entails fixing the position of the targets, noting changes in these positions and any facts effecting the general situation. In fact the main rôle of the intelligence is to prepare the way for fire effect.

(b) Direction of fire.

The aeroplane observer co-operates as regards fire direction by
(a) Conducting the shoot himself and sending down corrections.
(b) Collaborating with ground observers.
(c) Checking the effects of the shoot by photography or other means.

For effective co-operation certain requirements have to be met as regards personnel, organisation and communications.

(a) Personnel.

"The basis of successful co-operation between aircraft and artillery is mutual confidence." Too often mutual blame was the feature of shoots which had not quite come up to the mark.

As far as artillery is concerned an aeroplane is only a means of selecting an advantageous O.P. No battery commander allows an untrained officer to carry out a shoot unsupervised and as a corollary no observer should require this supervision. At the same time, the gunner must learn to appreciate the difficulties of the flying man and the trying conditions under which he has to work. There is quite enough for an observer to learn of the work of the two arms to justify a special branch of artillery observers. Failing this, observers and gunner officers should be encouraged to meet as often as possible and discuss their difficulties. If it can be arranged for the same observers to work for the same group of guns, mutual confidence based on personal friendship should ensue, or if the reverse a change is easy.

Organisation.

An organisation is necessary for the distribution of intelligence, photographs, etc., and also for the arrangement of programmes of shoots. This is merely liaison work of a somewhat specialised nature and its general requirements apply to most occasions when two technical branches of the service have to co-operate.

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Means of Communication.

Communication of intelligence normally implies a good telephone, despatch-rider service. It is only in the direct link, aeroplane to battery that special conditions prevail.

Wireless telegraphy has generally superseded earlier methods of establishing communication between the battery and the target. It has certain technical shortcomings, but, on the whole the system has proved satisfactory. If too many machines are employed simultaneously in a given area, a "jamming" effect is produced, it being very difficult to select the desired message at the receiving end. By careful arrangement beforehand, and in small operations, this difficulty largely disappears. The installation of the receiving set at present requires time, but developments in equipment may well reduce this to a period analagous to that required for laying out lines of fire. An installation of this nature would be of great value to the field artillery provided it was sufficiently portable. At present it does not appear practical to have a wireless installation in action with a unit whilst actually on the move, though this would obviously facilitate the engagement of fleeting opportunities and generally help to clear up the situation at any given time.

In the past owing to considerations of weight, etc., aeroplanes have not as a rule carried both a sending and receiving set. A direct means of communication to the aeroplane from the ground by means of wireless would greatly facilitate the shooting but the danger of the gun position being given away by "directional wireless" must be considered. In actual practice the communication battery-aeroplane has been confined largely to visual methods such as ground signals. Provided the nature of the communication required is simple the system of ground signals is fairly satisfactory. The information to be sent must be reduced to a minimum.

The wireless telephone is in a fairly advanced stage of development, but in spite of its obvious advantages, it suffers from the same defects as wireless telegraphy as regards jamming, etc.

Light telephony depending on the effect of rays of light on sensitive media such as selenium and the conversion of sound to light or vice versa, can only be regarded at present as philosophic conceptions likely to appeal to admirers of Scriabin's later musical efforts. In most cases of fire direction a code is used to point out the target and to correct the fire.

Information.

The aeroplane observer should endeavour to provide the battery commander with such information as he would presumably like to obtain, were his view not restricted on the ground.

Under this heading comes the location of new hostile battery positions, the activity of those previously discovered, new trench work and general movements over the hostile area. Most of this information will reach the battery commander indirectly through the intelligence organisation. Conditions likely to hold good over a considerable period such as the occupation of a gun position or permanent work is usually best revealed by aerial photographs. The reading of aerial photographs is a subject requiring special study. Photography needs, however, confirmation, generally by movement being spotted, etc. The observer must therefore be trained to

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grasp the meaning of anything he may see at one moment, the next perhaps being too late. Best results are only obtained by the exploiting every source of information to its utmost.

Continuous observation from the air over areas on which operations are expected or in progress is the best means of keeping in touch with and appraising the latest movements of the forces engaged. As regards artillery in mobile warfare aerial observation may be the only way of keeping higher formations informed of the movements of isolated units.

Observation of Fire.

As regards the actual direction of fire the sine quâ non of success is that observations should be accurate. This implies long training and constant practice on the part of the observer. Even this training and experience of the direction of fire may prove abortive unless carried out on a carefully arranged scheme as to time, areas, etc.

The main factors effecting the reliability of observation are:—

(1) The existence of features near the target which enables the observer to orient his "clock" on the ground and visualise the circles.

(2) Whether the shoot is pre-arranged or impromptu.

(3) Visibility.

(4) The distance of a round from the target.

The various natures of shoots with aerial observation are classified as follows:—

(1). Pre-arranged shoots, i.e., positions of battery and target known to the aeroplane.

(2). Impromptu shoots, i.e., position and arc of fire of battery known but position of target unknown until discovered by the aeroplane.

(3). Impromptu shoots—neither battery position known nor that of the target until spotted by the aeroplane.

The main characteristic of field artillery is mobility. This practically necessitates guns of comparatively small calibre and shell power. Heavier natures of artillery are usually employed in the destruction of material, hence the engagement of targets by pre-arranged shoots is mostly confined to these heavier guns. When field artillery is employed in pre-arranged shoots the usual codes are used and no special features arise.

Impromptu Shoots when the Battery Position is Known.

The target is indicated by the "zone call" system of map squares. The number of batteries to engage the target depends on its tactical importance at the moment. Code signals are accordingly arranged to meet the various situations and to inform the batteries if aerial observaion of fire can be expected. In certain cases where visibility is bad observations will be made on salvoes of rounds the nature of shell used being chosen by the battery commander for its visibility of burst.

Fleeting opportunities are engaged in the same manner, the essential feature being the rapidity with which fire is opened on the targets. As a rule definite batteries will be allotted for this task. These will respond to the "G F" call.

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In exceptional cases demanding the utmost concentration of fire available the "LL" call will be used when all batteries which can engage the target should open fire, unless by so doing too much ammunition would be expended or a premature disclosure of artillery dispositions would ensue. This call should only be used with the greatest discretion and implies a target of considerable importance such as a cavalry regiment or infantry battalion in the open. The observer must therefore have a thorough grasp of the situation. Exact orders should be issued as to the number of batteries and expenditure of ammunition to be used in response to this call. Although not to be used lightly, the sudden concentration of a withering fire on exposed hostile targets may have far reaching effects on operations. Considerable practice is desirable if fire is to be opened soon enough and good results obtained. Observations on the fire effect must not be expected except as a "post mortem" of results.

Batteries must be ready to put up impromptu barrages on receipt of the "PP" call.

Impromptu shoots when neither the position of the battery nor the target until spotted is known to the aeroplane.

Situations of this nature will probably arise during mobile warfare. Failing the possibility of the "zone call" system being used for indicating the target, the aeroplane should fly over the target discharging a Very light when vertically over it. Any battery in a position to do so should verify line and range as far as possible from this information and prepare to engage the target. Endeavour should be made to establish wireless communication with the aeroplane as soon as possible. Unless this is possible the battery commander should rarely commit himself to any considerable expenditure of ammunition unless further information as to the position and nature of the target reaches him from other sources. If wireless communication is established, observation of fire may be expected, but the value of these observations must be limited unless the battery position has been discovered by the aeroplane by spotting ground signals, etc.

A simple system of coloured lights or numbers of lights fired at pre-arranged intervals should however be devised to give a general indication of fire effect when wireless communication fails.

In engaging targets of this nature, many failures must of necessity occur owing to the difficulty of the problem. The solution of it is, however, of such importance that every endeavour should be made by constant practice and improvement in methods of communication to make the percentage of failures as small as possible. Experience has shown in the recent war how small incidents in a battle have eventually developed into decisive factors.

Balloon observation is merely a special case of aerial observation. As regards mobile artillery its chief function is intelligence. As opposed to the aeroplane the balloon permits of observation by night to a limited extent.

Conclusions.

The lines on which progress is most likely to be achieved may be summed up as follows:—

(a) The aeroplane should come to be considered as an integral part of an artillery formation. One might put it "to every brigade or battery its own tame aeroplane."

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(b) Observers should have such an understanding of the gunners' problem and vice versa, that as far as fire direction is concerned they should be almost interchangeable.

(c) The communication battery aeroplane should be quickened up as far as possible both in actual means of communication and in simplification of codes, etc.

(d) The problem of bringing fire on fleeting opportunities must be constantly worked on.

In fact let the aeroplane really become an advanced O.P.

PROTECTION AND CONCEALMENT FROM ENEMY AIRCRAFT.

Protection and concealment against aircraft must be regarded largely as passive measures of defence. First let us consider against what exact factors these defensive measures have to be taken.

An aeroplane observer derives his information from two sources:

(a) actual direct observation.
(b) photography.

He can utilise his information in three ways.

directly by (a) dropping bombs on the objective.
(b) machine gunning it.

indirectly (c) by causing artillery to concentrate fire on it.

In addition the information may be of value as general intelligence or for confirming other sources of information.

Visibility.

The factors governing visibility are in the main the same as regards actual observation as for photography.

Visibility is largely a matter of contrast.

The main reasons for attention being drawn to a given spot on the landscape are:—

(1) Movement observed round it.
(2) Its outline forming a contrast to the surrounding ground. Nature rarely produces sharply defined curves or straight lines in a landscape.
(3) Differences of colour and hence lighting effect. Well defined shadows may give a valuable clue to the nature of certain objects on the ground. The lighting effects often vary considerably with the time of day and atmospheric conditions.
(4) Special features such as gun flashes.

Concealment against aerial observation is of two kinds:—

(1) Concealment by taking advantage of natural features of the ground.
(2) Artificial concealment by rendering the position as similar in appearance to the surrounding country as possible—the "protective mimicry" of the animal kingdom.

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In practice a combination of the above two methods is usually employed.

As regards mobile artillery concealment will be necessary for both guns and wagon lines.

Natural Concealment of Gun Positions.

Owing to the requirements of the actual shooting it is rarely possible to hide away a battery completely by natural concealment. If the necessary field of fire can be obtained, woods are a satisfactory form of cover, but in practice the guns have usually to be placed on the edge of the wood or in clear spaces, both of which render them liable to discovery. Gun positions in woods are fairly easily concealed by artificial means and all movement about the position can be hidden. On the whole orchard country affords about the best natural cover as long as the trees are in leaf.

Owing to the broken nature of the ground mountainous country is also good for natural concealment.

Movement.

Movement is perhaps the hardest thing to conceal from the air. In the daily round of life at a gun position a certain amount of movement is inevitable. When hostile machines are about, no movement should be allowed unless absolutely necessary. Battery look-outs should be posted to give warning of enemy aircraft. This implies a knowledge of identification of types of machines. This is best obtained by sending men for short courses to neighbouring A.A. units. A fair standard of proficiency to demand from a look-out is to be able to distinguish type at 10,000 yards through an observation telescope. If a considerable amount of flying is being carried out thus on a particular sector of front, this standard should be reached in two or three weeks. Look-outs should not be content with verifying a given type in one position, but should endeavour to be able to "spot" it in all positions, approaching, crossing, receding, etc. He should also keep in touch with any new types which may appear from time to time. The subject of identification of aircraft is well worth study, as if the look-out sends the battery to ground for every aeroplane which appears, much time is lost and eventually the whistle is treated in the same way as the "Wolf!" Wolf!" of the fable. In addition to actual identification, the knowledge of which types the enemy uses for fighting, reconnaissance, and bombing is useful.

Traffic should not be allowed to collect near the position.

Artificial Concealment of Positions.

The general principles of "camouflage" are obvious, but their practical application requires an intelligent grasp of the situation. Gunner officers should take every opportunity of discussing with observers and "camouflage" officers as to what are their experiences as regards spotting positions. Apart from other reasons aerial photographs should be studied with special reference to concealment. Photographs of the actual position may give valuable information as to its visibility from the air. If flights can be arranged over the position, gunner officers should avail themselves of the oppor-

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tunity of seeing for themselves. The test, however, is not a very reliable one until the officer has had considerable experience of aerial observation.

The exact lines on which attempts at concealment should proceed depends largely on the circumstances, but the basic principle is as stated before "protective mimicry." Networks over the guns and all sorts of "camouflage" devices should be employed wherever possible.

Alterations in the Appearance of a Position.

When a new position is dug the work should be carried out as far as possible at times when flying is unlikely. As the work proceeds, steps should be taken to cover up newly-turned earth and other traces likely to give away the position. The pits should be covered up as soon as possible after completion. As work has often to be carried out against time, this may seem rather a counsel of perfection, but the principles should be applied where possible.

Once the new position is occupied there is a tendency for paths and beaten tracks to be formed round the guns. These should be limited as far as possible by orders to the men, and where necessary, steps should be taken to render these tracks, etc., as inconspicuous as possible.

The Flash of the Gun.

The discharge of the gun is a fruitful cause of a position being discovered owing to:—

(1) The flash.
(2) Dust raised by the blast.
(3) Marks made on the ground by the blast of the guns.

(1) The flash itself is most conspicuous in the half lights of dawn and dusk, and against dark backgrounds. Against light backgrounds when there is at all a glare, the flash is almost invisible.

Attempts have been made to render the flash less conspicuous by reducing its volume or giving it a less visible colour. Fair results have been obtained but only at the expense of increasing the volume of smoke formed, which is almost—if not more undesirable than the flash.

The best protection against being discovered by the flash of the guns, is to avoid firing, as far as possible, when hostile aircraft are about. In a general bombardment there is safety in numbers.

(2) The dust raised by the blast can be largely prevented by sprinkling water in front of the guns.

(3) Care should be taken to note the formation of blast marks, which should bc covered up as soon as possible.

Dummy Positions.

The construction of dummy positions may sometimes produce good results in diverting enemy attention. They must be just sufficiently obvious and the illusion should be helped out by dummy flashes, etc. As a rule, the crowded nature of trench warfare hardly allows room for such devices.

Wagon Lines.

Every precaution should be taken to conceal horse lines. They are extremely vulnerable to bomb and machine gun attack apart from shell fire.

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The horses should be kept in small bodies, thus limiting the effects of a chance bomb, etc.

The vulnerability of the horse and the difficulty of affording him adequate protection is one of the main reasons advanced by those who would dispense with horses in modern war.

Mobility.

If guns could retain their mobility, it would form a most valuable means of concealment and protection. The development of the tractor seems to point to "crawling" rather than stationary warfare. If the gun and tractor are combined in one vehicle the best mean of avoiding shell fire, etc., is to move elsewhere. At present elaborate systems of lines of fire, etc., are evolved for a given position and the fire effect depends on somewhat complicated figures derived from a knowledge of the exact position of the battery.

It is a point worth considering whether a more elastic system of fire control will not have to be evolved to meet new conditions, which render prolonged stationary warfare improbable. As a result of experience in advanced section A.A. work mobility has proved a great safety factor. It automatically "defeats" the aerial photograph.

Protection.

Permanent gun positions are only likely to suffer from hostile shell fire. With the usual amount of cover very few casualties will be caused by bombs and machine guns from aeroplanes.

Wagon Lines.

As has been already stated, wagon lines are vulnerable to bombs, machine guns and shell fire. Concealment is the first essential to look for, and this should be considered by day and by night. Means of adequate protection for horse lines will be rare. All available active means of protection should therefore be employed. This implies the use of machine guns with special A.A. sights. With practice fair results can be obtained against low flying machines.

On the Line of March.

Very little can be done for batteries on the line of march by way of concealment or for passive protection by day. Movements should accordingly be carried out as far as possible by night. If day movements on a considerable scale are contemplated, an escort of aeroplanes should be provided; and the A.A. batteries warned as to the route to be taken. Machine gun protection should be exploited to its uttermost. Protection of troops on the line of march against aerial attack is one of the most difficult problems raised by the advent of flying.

In occupying positions in open warfare, A.A. machine guns should be manned at once if available both at the guns and at the wagon lines.

"THE EMPLOYMENT OF ARTILLERY AGAINST AIRCRAFT."

Many people regard anti-aircraft artillery as being one of the lost causes of the recent war. It is argued that the aeroplane enjoyed comparative immunity from shell fire and that hence the aerial menace is best countered by defensive squadrons of aeroplanes.

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Incidentally in many cases these same people were often the first to complain if for some reason or another no anti-aircraft guns were on their particular sector. As a result of experience over a long period of the war, it was shown that both the average height of flying and the persistancy of reconnaissance of enemy aircraft was very definitely influenced by the presence of A.A. guns on the front. As the number of guns increased and with it knowledge of the problem, this effect became more marked and the number of aeroplanes brought down reached a comparatively high figure. What is so frequently lost sight of is that A.A. artillery was put to the severest of tests, namely, continental warfare, when in a period of extreme youth. During the pre-war period little or no progress had been made in evolving material or methods of training. The science of A.A. fire has grown to such an extent and the issues at stake are so big, that it is hardly too much to say that no gunner's education can be said to be complete without a rudimentary knowledge of the principles involved. It is the duty of the A.A. gunner to present the problem in a form robbed of too many indigestible bye-products of higher mathematics and "highbrowism." The A.A. problem has already been solved theoretically in its main issues. Its inherent difficulties and the remedies for them have been minutely examined. In certain directions there is still scope for inventive genius but progress is more likely to be achieved by the materialisation of what is already accepted in theory, than by revolutionary invention. It is better to concentrate on steady evolution rather than on haphazard brilliance in searching for the practical solution. Those connected with A.A. research have been down too many intellectual cul-de-sacs to imagine that there is an A.A. philosopher's stone which has only to be unearthed to dissipate all our troubles.

Before entering on the gunnery problem, a short summary of the tactical requirements and employment of A.A. guns will not be out of place.

It is difficult to evaluate the worth of the guns without considering them in co-operation with the other means of A.A. defence both active and passive. By these are meant, aeroplane searchlights, sound locators, nets, false areas, etc. The subject of co-operation on these lines lies outside the scope of this article, though obviously influencing the employment of guns.

Types of Guns.

Modern ideas on the employment of A.A. guns demand two, if not three, natures of equipment.

(a) Light guns for forward area use, roughly speaking with the mobility of Horse Artillery. To attain this mobility a certain amount of gun power will probably have to be sacrificed.

Tractor mountings may permit heavier guns to satisfy the above conditions.

These guns would be employed in direct contact with the enemy and would form the advanced A.A. screen. They should be specially designed for engaging low flying targets. They should also in emergency be capable of employment against land targets, especially tanks, for which purpose their "all round" traverse and rate of fire peculiarly suits them. Only in exceptional circumstances should, however, their normal rôle be interfered with.

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In moving warfare, to obtain full value from reconnaissance, aeroplanes will have to approach much nearer their objectives than on a more or less fixed front. Conditions would be changing so rapidly that elaborate photographic work would lose much of its value. Hence a light mobile gun would probably meet the requirements of the situation. The question of ammunition supply arises, and hence, if possible, the advanced A.A. gun should employ the same ammunition as other guns operating in these areas. In stationary warfare, "high birds" would be dealt with by the heavier A.A. equipments operating further back. For employment with the advanced guns, officers should be chosen for capacity for "eye shooting" (elaborate instrumental methods can hardly be employed under such conditions), quickness in grasping tactical situations, and lastly they must have "the will to war." A gun on the principles of the Pom Pom with automatic fuze setter would go far to satisfy the requirements of the advanced guns.

(b) Mobile heavy A.A. artillery, with at least the mobility of heavy artillery.

These should form the main A.A. screen of defence and should be capable of engaging targets at say, 16,000 feet 10,000 yards away from the guns. A gun of this nature has already been designed.

These guns should be employed as close up to the line as possible without hampering their mobility. (Mobility is the most reliable safety factor of the A.A. gun as opposed to its somewhat marked visibility in action.) As a rough guide to their position they should be working more or less in the field-heavy gun line and covering the advanced guns.

As a result of experience, these guns should be worked in groups of four or more if the tactical situation permits.

Instrumental shooting should normally be employed.

In an advance these guns should be sent forward as soon as possible. They will be of the greatest value during the consolidation of the new front or in the development of a new phase of the campaign.

(c) Semi-mobile or fixed gun defences for lines of communication, towns, etc.

These can be of any nature, but preferably guns of rather heavier calibre than those previously described should be used. Detailed defence schemes are necessary.

Types (b) and (c) require their complement of searchlights and sound locators, and also intimate liaison with the local R.A.F. units and with the Intelligence branch of the staff.

The determining factor as to the calibre of A.A. guns as regards fire effect is a compromise between the weight of shell and hence the radius of effect of the burst and the rate of fire which can be maintained. Recent trials have produced results bearing on this problem.

The number of guns required for A.A. defence in the area of actual operations (the front and say 10,000 yards back from it) is generally considered to be met by a provision on a scale of twelve guns (4 light, 8 heavy) per divisional front. This, however, does not imply a divisional organisation.

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All means of A.A. defence, except possibly those of a purely passive nature, will normally come under the tactical control of the anti-aircraft defence commander. (A much-criticised title not necessarily implying a gunner—"quot homines"!)

The work of the advanced A.A. guns is of such an independent nature that in mobile warfare advanced area A.A. defence commanders will probably have to be appointed with considerable powers of independent action.

Outline of the Problem.

The problem of bringing effective fire to bear on an aerial target resolves itself into three main processes.

(a) The determination of the present position of the target, i.e., at the moment the gun is fired.

(b) The determination of the future position of the target, i.e., the position at which it is hoped to destroy it.

(c) The determination of the gunnery factors, elevation, fuze, etc., so as to obtain a burst at this future position.

The first two processes are geometric whilst the third is a question of pure gunnery.

The main difficulty in the solution of each is the speed of the target, which is displacing itself at 50 or 60 yards a second or even more.

Sufficiently accurate data must accordingly be obtained with the least possible delay and hence the various processes must be as far as possible simultaneous.

It is clear that direct measurements are only possible on the present position of the target. The future position must be deduced from these measurements. Certain assumptions have accordingly to be made based on the somewhat pious hope that certain conditions will prevail over the period occupied by the time of flight of the shell.

These assumptions are as follows.

(a) That the target will keep on a constant course during the time of flight of the shell.

(b) that the height of the target will remain constant over this period, or, as more modern views would express it, that if the height does not remain constant, that the change of height is at a constant rate.

On these two rocks is built the science of A.A. gunnery as opposed to promiscuous "browning" of aerial targets. Provided the present position of the target is reasonably accurately estimated and the above assumptions hold true within certain limits, the third process, namely, the gunnery one, is comparatively simple, at least as far as it can be controlled by the gun commander. Further, if the time of flight for a given range be reduced the chances of these assumptions being true becomes greater. Unfortunately the reduction of the time of flight beyond certain limits introduces other considerations which preclude this reduction beng carred out in practice.

These assumptions have shown themselves to be thoroughly justified by experience.

Much of the problem can be solved in a preliminary stage on the general lines of calibration, etc.

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The Determination of the Present Position of the Target.

A point in space with reference to a gun can be determined by knowing the bearing, angle of sight and any of the following factors, height, range along the line of sight, or ground range.

The bearing and angle of sight to the present position of the target are easily obtained.

The other factor usually sought for as has been previously explained is the height of the target.

Two methods are employed in finding height.

(a) Short base instruments on the principle of the ordinary range finder with a means of converting range along the line of sight to height. To assist the range-taker independent means are provided for laying the instrument. The service instrument employed is the two metre Barr and Stroud range-finder wtih automatic gearing for converting range to height. With trained observers accuracy to within 3% at 8,000 yards should be obtained.

The great advantage of this instrument over previous types is that provided the height remains constant, the range-finder cut on the two images will also remain constant and the process resolves itself into merely laying on the target. If the "cut" needs adjusting it implies a change of height in the target.

(b) Long base instruments.

Direct readings of height can be obtained by measurements taken from the ends of a base of known length (generally about 1 mile), communication between the ends being established by telephone or other means. The principle consists in rotating planes on parallel axis until the lines of sight to the target from both ends of the base are contained in these planes.

The consideration of the angles through which these planes are rotated can be employed to determine the height of the target.

The actual solution is given by the relation

$$\text{Height} = \frac{\text{base}}{\cot A - \cot B}$$

Where A and B are the angles through which the planes are rotated in order to lay on the target.

In the latest types of height-finder use is made of the above relation by direct readings in terms of cot A and cot B. Once this difference between cot A and cot B has been determined at the near end of the base, provided the height remains constant the process again resolves itself into laying, the figures coming in from the far end of the base merely being a check.

If the difference between cot A and cot B alters it implies a change in height.

Both the instruments described are post-war products as far as manufacture is concerned and both combine accuracy and simplicity in use.

The A.A. problem of necessity involves complex principles as compared with land gunnery, but provided the processes to be carried in the actual attack of the aeroplane are simple and easily mastered there should be no cause for complaint.

Long base instruments are more accurate than short base ones, but in practice they present certain difficulties, such as pointing out

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the target to the far end of the base, maintenance of communication and owing to the fact that laying out the base requires considerable time.

In general it may be said that short base instruments are more suited to the actual attack of aeroplanes whilst long base instruments can be advantageously employed in defence of a more or less permanent nature and for purposes of calibration. It will be noted that the two instruments described above are on a fair way to offering a means of calculating rate of change of height.

The Determination of the Future Position of the Target.

The future position of the target differs from the present one by an amount equal to the travel during the time of flight of the shell. This travel depends directly on the speed of the target and the time of flight and entails a change of bearing, angle of sight and range.

The change of bearing and angle of sight are known as the lateral and vertical deflections respectively.

All calculations are based on the assumption of constant course.

In practice the amount of these deflections are calculated instrumentally or by estimation.

The most usual instrumental solution is the "tachymetric" or angular velocity method.

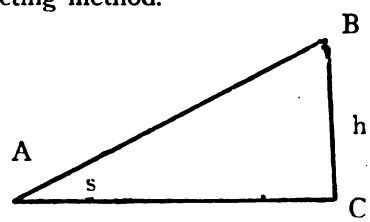
Sighting telescopes are kept laid on the target by movement in a vertical and horizontal plane by means of geared handles. The rate at which these handles have to be turned to keep the telescopes laid is therefore a measure of the angular velocity at the moment. This angular velocity is then multiplied by the time of flight of the shell (usually automatically) and the result in terms of vertical and lateral deflections conveyed to the guns.

The service instrument of this nature is known as the Brocq and gives an electrical solution of the problem. The deflections are eventually passed direct to voltmeters placed on the guns in positions convenient for the deflection setters.

Unfortunately the angular velocity of a target is constantly changing. The tachymetric method multiplies the initial angular velocity by the time of flight instead of the mean angular velocity, thus introducing what is known as a "secondary error." This error follows a definite mathematical relation and is usually allowed for by curves on the deflection dials of the guns.

A further error known as the "complementary error" is introduced in the gun sights. This error, which only affects the vertical deflection and is a function of the lateral deflection, has also to be corrected for on the dials of the gun.

(b) The future position of the target is sometimes determined by the plan predicting method.



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In diagram A B is supposed to be a sighting apparatus. B C is a bar connected to A B and capable of adjustment to height at any given scale. If the target is laid on and B C is proportional to the height then B is the present position of the target to scale C the projection of it on to the horizontal plane.

A C then becomes the ground range at any moment and hence the rate of change of the length A C is the rate of change of ground range. This change of ground range over unit time multiplied by the time of flight of the shell gives a position of C so that A C is the future ground range. The future bearing is calculated directly. From the ground plan of the future position of the target thus obtained the necessary data for opening fire can be deduced. No secondary errors are introduced. This method is largely used in indirect fire instruments.

(c) The goniographic method.

This method consists of considering the difference between present and future positions of the target, in terms of linear speed, time of flight and angle of approach. These data are converted by drums forming part of the sighting of the guns into vertical and lateral deflections. The method was extensively used on French A.A. equipments, but in spite of being attractive in certain ways little development can be hoped for on these lines. It may be regarded as a cul-de-sac.

The methods described above determine the future bearing and angle of sight. Future range is obtained from the intersection of the future line of sight on the height (assumed constant or changing at a constant rate. For purposes of determining future range the vertical deflection for obtaining the future line of sight is calculated over a period of time made up of the time of flight and the time taken between the fuze being ordered and the gun being fired with a shell set at that fuze. This latter period is known as the "lost" or "dead" time. It only affects questions of range. In the case of deflections the target is usually being continually layed on and hence a short "dead" time does not matter.

Dead time is usually accepted as a constant of 8 seconds though a dead time varied to suit certain conditions would be more accurate.

THE DETERMINATION OF THE GUNNERY FACTORS NECESSARY TO OBTAIN A BURST AT THE FUTURE POSITION.

There are several gunnery peculiarities which enter into A.A. fire.

(a) Tangent elevation for a given range along the line of sight varies with the angle of sight following the approximate relation.

TE for x yards range at angle of sight s = (TE for x yards at angle of sight zero) $\times \cos s$.

(b) A given fuze setting burns for a varying period according to the trajectory.

(The burning of fuzes in the higher atmosphere has been generally unsatisfactory. Above 16,000 feet many "blinds" are obtained even with fuzes well looked after. The introduction of a mechanical fuze is highly desirable).

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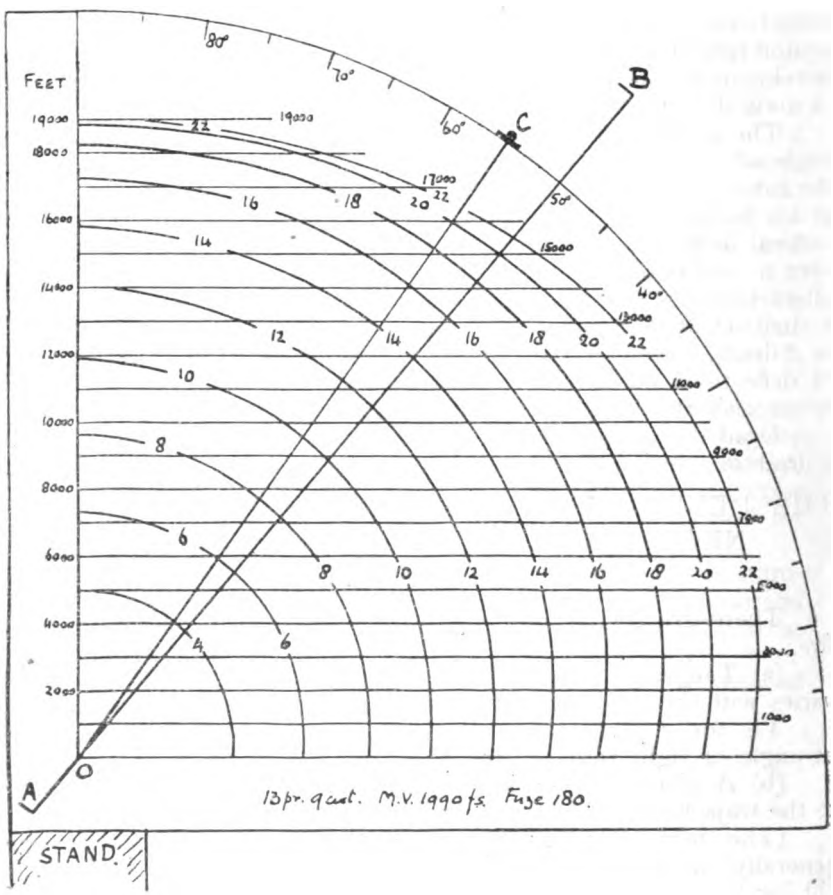
The difficulties of selecting the correct TE for a given fuze at any angle of sight are got over mechanically on the gun mounting itself. The solution either takes the form of a TE dial graduated in curves or of what is known as a "cosine" strip. In neither case is the work of the detachment made appreciably harder.

The A.A. gunner employs fuze lengths rather than linear units when dealing with future range. The actual choice of fuze length to be employed is obtained by use of the height fuze indicator, of which several patterns exist, some on and some independent of the gun.

The principle consists of having a vertical plate on which fuze lengths from a given point and heights are engraved a sighting bar moves across this plate and is layed on the target. Moving with the sighting bar capable of independent vertical motion is a second bar which can be set to the future line of sight. The intersection of this bar on the height line ordered allows a suitable fuze to be read off.

The diagram below makes this clearer.



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The plate is engraved as shown. A B is kept on the target at any angle, say s°. D C moves with A B but in addition has an independent motion which allows it to be set at s° ± the vertical deflection calculated for the time of the shell + the dead time. O C is then the future line of sight. The intersection of O C on, say the 13,000 feet height line, permits fuze 14 to be read off. Forming part of the Brocq tachymetric instrument is an electrical Fuze Height Indicator giving similar information automatically. The indicators usually have means for applying ballistic corrections in terms of percentage errors. Bursts of four or five rounds at the same fuze setting are employed. As the angle of sight is changing during this period (say 15 seconds), bursts are obtained at varying heights. The moment to open fire is so arranged that the bursts should appear some above, some at, and some below the estimated height of the target.

This method of fire is known as "zone" firing. A zone should not, however, be regarded as a barrage in the accepted meaning of the word but rather as a series of rounds designed to absord errors in the calculation of the height of the target. Thus each shot is a potential hit and fire is not employed as a screen to deny certain points in space to the enemy. Certain schools of thought are in favour of employing large calibre guns against aircraft, relying on the increased radius of effect of the burst to compensate for the slow rate of fire. At the present stage of development, however, a system of single rounds for effect is hardly justifiable.

Barrage fire in the screening sense is used in protecting objects of military importance such as bridges, kite balloons, etc. The use of a barrage system implies that to attack the object which is being defended the enemy must approach to close range and pass over areas which can be previously registered.

Observation of Fire.

An aeroplane offers a series of fleeting opportunities to the A.A. gunner, each of which must be dealt with on its own merits.

Successive salvoes of fire based on corrections can be fired say every thirty seconds. In thirty seconds the character of the target will have changed even if it keeps on a constant course. An obliquely approaching target gradually becomes a crossing one and vice versa. If, for example, "Right 6°" is given to the gun and the burst corresponding to it is seen 1° to the left it merely implies that the order should have been "Right 7°. It does not imply that 1° more right will be the correction for the next burst of fire, as would be generally true if firing at a stationary target.

Two sources of error must, therefore, be corrected for in the new salvo of fire.

(a) Corrections for the change of angle of approach of the target.

(b) Corrections for the error shown by the position of the bursts of the previous salvo.

The exact cause of these latter errors is not easy to judge.

The basic principle of A.A. fire can be stated in the words of the French A.A. manual: "On ne régle pas le tir sur avion, on le prepare." We must eliminate all possible sources of error before the target appears. In land gunnery this is done by calibration, etc.,

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and a final check is made on a reference point, or on observations on the target itself. The A.A. gunner has no reference point he can refer to during fire on an aeroplane. His only reference point is the intersection of the trajectory on the line of sight of a series of rounds fired preparatory to coming into action. By observation of these bursts he must apply corrections which will make the gun and instruments behave in a known manner.

If this preparatory stage of calculations is well carried out and if the instruments and gun are properly designed, provided the assumption of the target keeping a constant course remains true, bursts should be obtained on the future line of sight.

Spotting corrections if necessary should be due to some change in conditions since the preparatory calculations were made.

This may seem a counsel of perfection, but it is certainly an ideal which should be worked for.

"Eye shooting" for deflections, that is, shooting without instrumental aid, must however be practised. Targets suddenly appearing at close range or out of clouds have usually to be engaged in this manner. Constant practise in estimation is necessary if good results are to be obtained and also a thorough knowledge of the general tendencies of deflections. In peace time adequate training can be obtained from miniature ranges, etc.

Distant Observation.

Attempts have been made to correct for range on aerial targets by observations from a flank. The idea is a radical fallacy when applied to anything but a stationary target. A partial solution is to send from a flank corrections as to the height of the bursts as compared with that of the target. If these observations can be made (no easy matter), provided the target remains at a fairly constant height, the information is of a certain amount of value. Modern thought entirely discounts the use of distant observation, however attractive it may appear superficially.

Ballistic Corrections.

From the methods described we are on a fair way to solve the problem. There are however other factors affecting our fire: (a) wear of gun, (b) atmospheric conditions, (c) wind. These must be corrected for as far as possible in the preparatory stage of operations.

(a) *Wear of guns.* A given wear of the bore has been reduced to a corresponding loss of muzzle velocity and hence a correction can be applied.

(b) *Atmospheric conditions.* Under given conditions it is required to determine the behaviour of the gun. The gun is fired at a given Q.E. and fuze setting to obtain a burst according to the range table at, say, 10,000 feet. If by actual measurement the average height of a series of bursts is found to be 9.500 feet, then the atmospheric conditions are causing a 5% error in calculations as compared with the range table. Once this percentage has been established it fortunately may be taken as true for all heights and applied as a correction to the fuze height indicator.

Methods are being evolved for determining this percentage error without actually firing. The processes involved are at present somewhat complex.

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(c) *Wind.* The only effect of wind not taken up in the instruments is that of wind on shell. The shell passes at various angles through various strata in which winds of different strengths and directions prevail. The underlying principle is to reduce these various factors to an equivalent constant wind over the whole of the trajectory and hence to determine its effect on the shell. This effect is applied to the guns in the form of a correction and suitably modified as the bearing of the target changes. It must, however, be admitted that the problem of wind on shell has not yet been entirely satisfactorily solved.

(d) *Drift.* Drift is compensated for in the sighting gear on the guns and is treated in different ways according to the nature of the equipment.

Indirect Fire.

The development of A.A. fire tends towards the use of indirect fire. The basic idea is to sum up the calculations for the future position of the target at a central instrument and send the results to the gun in terms of a bearing and angle of elevation.

The advantages claimed for this method are as follows:—

(a) The control of any number of guns grouped together is greatly facilitated and layers' errors done away with.
(b) Additional cover for the detachments.
(c) The target need only be picked up by a minimum number of men. This factor is of great importance in A.A. fire.
(d) Economy of personnel.

Against these advantages may be advanced the difficulty of passing bearings etc., to the guns without delay and also the difficulty of correcting for displacement differences between the guns and the central instrument, if such corrections are necessary.

Both these difficulties are in a fair way to be overcome and this method of fire is likely to become the normal one except for advanced mobile guns.

Night Firing.

Firing by night should simply be regarded as a special case in which the difficulties of determining the present position of the target are accentuated. If the target is caught and held in the beam of a searchlight the procedure for engaging it offers no special features.

The developments of the science of sound locating may allow calculations of height, speed, etc., of an enemy machine to be made with considerable accuracy without it being actually visible. Even in its present stage great advances have been made as compared with what was known during the war.

THE EMPLOYMENT OF LAND ARTILLERY AGAINST AIRCRAFT.

Assuming that the exigencies of their normal role permit, land artillery can to a certain extent help in A.A. defence. As a rule this help must be confined to barrage work such as protection of balloons, bridges, etc., or to firing on "passing points." By "pass-

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ing points" is implied a method of fire in which the aeroplane is not layed on, but fire is directed on a point in space with a view to obtaining bursts there at the moment when the aeroplane reaches this point. Against patrolling machines fair results can be obtained by this method, especially when range can be given by the forward observing officer or by other means.

Batteries at rest might be employed in protecting bridges, etc., but this would make the term "rest" even more of a euphemism than at present.

To sum up, our hopes of anti-aircraft gunnery remaining a "live" proposition rest on the following demands:—

(a) *From the A.A. gunner himself.*

(1). A quickness and smartness in decision bearing some relation to the quickness of the target—no mental "dead time."

(2). A fair knowledge of the problem in theory but an exact knowledge of how to get the most out of his equipment. In all matters of drill he should exact from himself and his command "l'automatisme obtenu seulement par la repetition." In return the aeroplane will offer all the excitement of game shooting plus a little extra.

(3). He must play up for his show. In spite of criticism most A.A. gunners are human; some even ride horses.

(b) *From the rest of the Regiment.*

(1). A realisation that it is up to the Regiment as a whole to endeavour to solve this problem, which in the future may well surpass in importance all other gunnery issues.

(2). Constructive and not destructive criticism.

"L'art est difficile, la critique est aisee."

(c) *From the manufacturer.*

(1). A gun which does as it is told, i.e., puts on deflections corrected for secondary errors, etc.

(2). Good gears both in guns and instruments. Elaborate calculations are often based on data arrived at from the rate of turning handles geared to the sighting telescopes.

(3). An accurate fuze presumably of a mechanical nature. If this is obtained some form of automatic fuze setter is a natural corollary.

(4). The ideal instrument apart from considerations of portability and capacity to stand rough usage, should

(a) reduce the time between taking measurements and opening fire on a target to a minimum.

(b) repeat these measurements continuously with a view to establishing the rate of change and hence the new values of these measurements.

If progress is made on the above lines, the attacking aeroplane will no longer enjoy that immunity from destruction which has hitherto been regarded as due to the shortcomings of one, and of one only, of the various means of A.A. defence, namely, of the guns.

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ORGANIZATION OF THE BATTERY SIGNALLERS IN A SEPARATE SECTION.

(Criticism of the article in the May number of the Journal submitted by Major J. B. Walker, D.S.O., R.G.A.).

By Major H. J. Humphreys, R.G.A.

IN the year 1912 I submitted an article to the R.A. Institution which I christened "A Plea for E Sub-Section." In those days the Home Army possessed two Brigades of Heavy Artillery each with 3 batteries of 4 guns. I was reconnaissance officer in 48 Heavy Battery of the 2nd Brigade, and certainly experienced a great difficulty in gathering together the whole of the Battery staff for training purposes. The staff being distributed throughout the sub-sections, men were taken away for various administrative duties whenever I particularly wanted them for technical duties; at length, in desperation, I drew up a scheme based on lines exactly as Major Walker now puts forward but with only a 4-gun Battery—my aspirations were not so high as to form a Section. I pleaded for a separate sub-section with its own No. 1.

The Committee of the R.A. Institution considered my paper on the subject but finally rejected publication in the Journal as such organisation at that time was not favourably considered by my Brigade Commander. The Brigade Commander had many points against such a scheme and I remember feeling very strongly in favour of it. The Battery Commander saw the good points and the bad points but diplomatically remained neutral.

Since those days, having had the experience of commanding both a Field Artillery Battery and a Horsed Heavy Artillery Battery, I have changed my views to those of my Brigade Commander, viz: that the distribution of the communication staff throughout sub-sections is the better organisation. All that is required to make it a success is good Battery internal administration, with the continual watchful eye of the Battery Commander on the Battery Sergeant-Major's duty roster.

I do not propose to take each paragraph of Major Walker's article and offer either destructive or constructive criticism, because there is in my humble opinion a very great deal in what he proposes; but, speaking generally, by his suggested arrangement one tends to divorce the gunner from his legitimate work, viz: gunnery. All ranks in the Battery should be capable of working the guns. Guns are liable to be sent off singly. All must therefore know their gun

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and be ready to take their place as any number in the detachment—even drivers should not be excused some training in this important duty.

With regard to single guns being detached, a complete communication party is required as much as a Battery, though perhaps reliefs need not be provided up to the same scale or even the elaboration of a double line of communication; organisation must therefore be on the basis that each gun can be detached with complete personnel fully trained to take their places in action, either as gunners or communication specialists. Gun drill! Gun drill!! Gun drill!!! and more gun drill, is a weary training for the average man who happens to be in a detachment, and by encouraging these detachments to learn something of the duties of the communication party and vice versa, one provides a more pleasant training and, what is more important, a reserve for both crews. In the weary days of trench warfare it was a great relief to many gun numbers who could use a telephone to change round with a signaller for a bit, and it is surprising how this little liaison created "esprit." It presents itself in games also, and I venture to suggest that such "esprit" is of more value where the technical duties of sections are the same, than where they differ—the section being on an equality for all purposes.

The communication specialists undoubtedly draw into their party the majority of those who make the best N.C.Os; but one cannot have all the N.C.Os. of the battery in one section. At the same time one should not debar the right man from promotion; consequently, one must have the personnel of both communication specialists and gun crews capable of changing round to a small degree without disorganisation. This seems to me a very strong point in favour of distribution, as when promotion is given to a good man he need not always be taken from his section. The "esprit de section" is still maintained, and further, the man who has changed his official technical duties is still in the section and can help it to carry on in the event of casualties.

Do not let us divorce our communication specialists from the gunners; rather let us make them liaison more and encourage the most desired military spirit of "Co-operation."

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SOME EPISODES DURING BATTLE-FIGHTING ON THE WESTERN FRONT.

Continued from the November number of "The Gunner" (old issue).

Communicated by

MAJOR-GENL. SIR H. C. C. UNIACKE, K.C.M.G., C.B.

XIX. The action of the 16th Divisional Artillery Group in the battle of 4th April, 1918, in front of Amiens.

THE action on the 4th April, 1918, opened at 5-30 a.m. with a heavy German bombardment of all Battery positions, roads, villages and approaches, and in the vicinity of Divisional Headquarters.

During the first hour or so gas shell were freely used, but owing to the efficacy of the men's masks, and the somewhat unfavourable atmospheric conditions, this in no way interfered with the efficient service of the guns.

It soon appeared palpable, from the nature and extent of the enemy's artillery fire, that an attack was imminent and all Brigades of the Group* were ordered to commence "counter-bombardment." This was kept up until 6-20 a.m.—batteries firing concentrated bursts on likely places of assembly and on all approaches. During this time, and until about 11-0 a.m., the visibility was very bad. A dense mist blinded our O.Ps. and F.O.Os.

At 6-20 a.m., the hostile barrage having dropped on to our front line trenches, Brigades were ordered to open on their S.O.S. lines at a slow rate of fire and were warned to be ready to increase to S.O.S. rates as the hostile barrage lifted, or an attack developed.

From now onwards varying rates of fire were carried out by Brigades according to the changing circumstances of the battle. There was little definite information from in front and such information as was gleaned from wounded men and stragglers was by no means reassuring. As a specimen of the sort of messages received it may be noted that at about 8-0 a.m. a report reached Divisional Artillery Headquarters that the enemy had attacked at Marcelcave and driven our infantry out. At the same time a runner reached the 177th Brigade R.F.A., through the Brigade of the 1st Cavalry Division which had been pushed up to re-inforce the line, bringing

* 177th Brigade, R.F.A.
180th ,, ,, } 16th Divisional Artillery.
277th Army Brigade, R.F.A.
174th Brigade, R.F.A.
186th ,, ,, } 39th Divisional Artillery.
46th ,, ,, 14th Divisional Artillery.

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a message that our Infantry at Marcelcave had fallen back. An orderly from a Brigade further south also arrived to say that the enemy had broken through on the right and that his Brigade would be forced to withdraw their guns. This, like many other reports of a similar nature, proved quite untrue and naturally did not help to throw light on an already obscure situation.

Notwithstanding these reports—the accuracy of which could not at the moment be questioned—it was considered inadvisable to drop from the original S.O.S. barrage line in case parties of our men should still be holding out in front. Brigades were, however, ordered to deal at once with any bodies of the enemy which could be positively identified as such.

At about 8-55 a.m. C/177 and D/177 Batteries turned on to advancing German infantry, catching them in enfilade and breaking up the attack completely. An hour later a message was received from the right Infantry Brigade to say that the guns had totally annihilated the Germans on their front and that *for the time being* there was no sign of anything in the nature of a hostile infantry attack in that locality. C/177 Battery had been ordered into action the previous day across the Somme, North of Vaire, and was therefore in a position to enfilade completely the attacking waves of the enemy as they advanced and to fire into their backs should they succeed in reaching our front trenches. It continued to do this throughout the day and contributed most materially towards breaking up attacks and causing the enemy heavy casualties.

At 9-45 a.m. another attack developed and all Brigades again opened fire at S.O.S. rates.

At 11-0 a.m. the visibility improved considerably and the whole of the Batteries of the six Brigades forming the Divisional Group were able to deal with the advancing enemy by observed fire from their O.Ps.

From now onwards reports from O.Ps. and F.O.Os. came in regularly and gave most accurate and valuable information. The work of the Observing Officers, carrying out their duties as they did in the open with no cover of any sort or description and under constant heavy shell fire, was beyond all praise.

At about 10 a.m. it became clear that the Germans had pushed their way into our original front trenches on the whole Divisional front. At 10-50 a.m. D/177, which was in action south of Vaire, reported that the enemy were on the ridge east of Hamel and that parties of our infantry were falling back from Hamel to Vaire.

Up to this time the enemy had been dealt with by the batteries from their positions under cover, but shortly after 11-30 a.m. the situation became far from satisfactory. The enemy continued to advance and to attack in wave after wave, and although one attack after another was broken up by artillery and machine gun fire, renewed assaults by fresh troops continued to be made at intervals.

The Infantry holding the front, suffering from the strain of incessant fighting, were too tired and exhausted to withstand these continuous attacks and began to fall back along the line.

The Brigade of the 1st Cavalry Division in reserve had been thrown in to fill a gap and were hard pressed.

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A portion of the 3rd Cavalry Division which had come up during the morning had also gone up and were holding the line thinly against heavy odds. Only a few isolated posts of Infantry now remained in front of the guns on the northern half of the Divisional front.

At 12-15 p.m. therefore the following order was sent out by Divisional Headquarters to all Brigades: "This attack must and can be stopped by artillery fire. If any battery can no longer effectively stop the enemy from its present position it will at once move fighting to a position from which it can do so. If necessary batteries will push guns up to the crest to engage the enemy over open sights. It is essential that the Artillery should hold the line and they will do so."

This order was given with a view to dealing with what appeared to be a somewhat critical situation and was nobly responded to by every unit in the Divisional Group.

B/180 at once moved out into the open so as better to engage the advancing German infantry. A/180 and C/180 pushed forward on to the crest and took on the enemy over the open sights.

One gun of C/277 fired from a fully exposed position right out in the open from 12-40 p.m. until 2-30 p.m. D/277 obtained some lethal shell and moved up and fired them into the enemy seen massing east of Hamel.

The Batteries of the 177th Brigade R.F.A. advanced guns into the open in every case where they could not otherwise engage the enemy by observed fire.

Numerous concentrations, attacks, and massing of the enemy infantry were reported by F.O.Os. and dealt with by the concentrated fire of Brigades or by individual batteries.

An O.P. was established on the top of Hamelet Church, and this, manned by officers of the 177th Brigade R.F.A. Headquarters Staff, gave most valuable tactical information throughout the day. No chance of inflicting loss on the enemy was missed and the Germans were seen to suffer heavy casualties everywhere.

At 11-45 a.m. D/177 moved from its position south of Vaire to tht vicinity of Hamelet village in order to get a better field of fire and from there continued to fire with excellent effect for the rest of the day.

At 1 p.m. the position of B/180 in the open exposed to observed rifle, machine gun and artillery fire became untenable. It was therefore withdrawn to a position giving some cover but was forced to leave two guns behind, for the time being. These guns were withdrawn later in the day and the battery continued in action from its new position. At this time Major Donald Mackay, M.C., seeing large bodies of the enemy on the high ground east of Hamel advanced his battery, B/177, to the crest of some rising ground in order to engage them more effectively. From there the battery fired over 90 rounds a gun over the open sights into the enemy with shattering results, completely clearing the Hamel ridge. The battery then withdrew under cover—their total loss during this very successful manœuvre being only one man wounded. This same battery a few days previously had suffered so heavily from enfilade artillery and machine gun fire in carrying out a similar operation that only six

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gunners were left capable of working the guns. Their spirit was, however, quite unbroken, and they were prepared to follow their gallant Battery Commander anywhere and everywhere, whenever called on to do so.

At 1-35 p.m. A/180 fully exposed in the open was so neutralised by continuous hostile shell fire that it could not bring properly effective fire to bear. The guns were therefore withdrawn to a position under cover. This was no easy task owing to the intensity of the enemy's artillery fire. One gun had to be left behind temporarily as the team coming up for it was completely destroyed; but the gun was withdrawn as soon as another team could be brought up.

By 1-45 p.m. C/180 in its open position had had two of its guns knocked out by shell fire and had lost its Battery Commander, Major Ormond Steven. The situation becoming somewhat easier, the serviceable guns were taken back under cover—the two damaged guns being recovered at dusk.

All guns not in action on the crest or forward in the open now continued to fire from covered positions close up to our front line, their fire being observed from the crest close in front of the guns, and prevented the enemy from debouching from the Bois de Vaire, the low ground south of it, and from the neighbourhood of Hamel.

Soon after 3 p.m. all reports showed that the enemy had at last abandoned his attempt to take the Hamelet Ridge. At 3-30 p.m. therefore orders were sent out from Divisional Artillery Headquarters to stop firing. The batteries were then in action within a short distance of our front line. They had fired incessantly for over 10 hours and had expended on an average some 500 rounds a gun.

The strain on officers and men, who for the previous 15 days (since 21st March) had marched and fought without cessation, exposed throughout the day to heavy artillery, machine gun and rifle fire was very great. All ranks, however, though tired and worn out and suffering greatly from want of sleep, responded nobly to the urgent call made upon them. Their behaviour was magnificent, the one idea of all being to hold the line whatever might befall and whatever the cost.

The batteries were fighting with very reduced strengths. Several Battery Commanders and many officers, N.C Os. and men had fallen during the previous fortnight but this in no way interfered with the service of the guns. The behaviour of these New Army batteries was on this as on all other occasions in keeping with the best traditions of the Regiment.

In the foregoing account individual reference has only been made to the 177th, 180th and 277th Brigades R.F.A. The 46th, 174th, and 186th Brigades, formed into a sub-group and covering the southern half of the Divisional front, acted with equal gallantry and resource—their batteries advancing into the open and beating off attacks by firing over the sights. They, too, worthily upheld the reputation of the Artillery of the New Armies—a reputation the memory of which will be cherished in The Royal Regiment for all time.

(To be continued).

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"ON PACK ARTILLERY GUN DRILLS AND EQUIPMENT."

BY CAPT. A. L. PEMBERTON, M.C., R.G.A.

MANY centuries ago that shrewd and epigrammatic people, the Romans, gave vent to the dictum that "LABOR OMNIA VINCIT," and it would seem as though, in the compilation of some of our official hand-books on section gun drill, we had placed too implicit a faith in early Roman sagacity. Work is undoubtedly a most effective cure for a very great number of evils but, with a caution begotten by experience, we hesitate to commit ourselves entirely to a belief in its universal application. Our Aryan brothers, who seem to have inherited something of the Roman faculty for apothegms, have invented a word called BAND-O-BAST, which in the East may be said to stand for everything else except physical labour. To us neither of these two extremes appear to be altogether justifiable, but we would seek our salvation in a just compromise between the two.

F.A.T. 1914 tells us that it is the divisional Artillery Commander's duty "to see that the principles laid down in the various training manuals for the guidance of the artillery are adhered to"; and again that "drill is an essential factor of all training." So much is of course obvious, but what seems to have escaped some of us is that if drill is an essential factor of all training, then uniformity of drill is even more essential, not only throughout the battery but throughout every unit in the Regiment that is armed with the same weapon. More than that, we might say throughout all branches of the Regiment that embrace the same idea. Now all pack artillery weapons, be they guns or howitzers, embrace the same idea and this connection of ideas should surely be visible in the gun drills for the 2·75 in. Gun and the 3·7 in. Q.F. Howitzer. But turn to the official handbooks and what do we find? Nothing but discrepancies! The guiding principle has apparently not been "Here we have two sorts of weapons that come to pieces and go on to pack saddles. How far can we possibly make the drill for each agree?" but rather "Here is a gun and there is a Howitzer. Of course the two things are as far apart as the poles." And yet if we look back at the late war, we find the introduction of the 106 Fuze and the improvement of ballistics gradually merging the two into one composite weapon, the gun-howitzer.

This question of uniformity in drill is nowhere of such tremendous importance as it is in dealing with Mountain Artillery. No one who has not endeavoured to crawl up a nallah about three feet deep with eight or ten loaded mules in full view of hostile machine guns and artillery, can appreciate what it means to the mountain gunner. How often have we not had cause to lament the mistakes of Gunner

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Bloggs, who has just arrived as a reinforcement from another battery where "We always used to do it like this, Sir"; and is constantly making a dash at the wrong mule at critical moments. At practice camp under the eye of the Umpire it would be annoying. On the hillside under fire it may well be disastrous.

But if we are going to demand implicit obedience to the drill book from our battery commanders it then becomes incumbent upon us to ensure that that drill book is the very best that we can produce, and always kept up-to-date. It must not be like the law of the Medes and Persians that changeth not—and consequently grows out of date and is ignored or disobeyed. Like the sacrificial sheep it must be without blemish, and it must enunciate its orders in no uncertain manner. The writer has, up to date, seen three different copies of the 3·7″ How. Gun Drill, all dated about the same time, and they all differ in several quite important details! As regards the 2·75″ gun drill, dated 1914, we are tempted to wonder how much expense the Government might have been spared, had the matter been left in the hands of the battery commander from the start. To take only one example, with the recoil cradle mule standing at Action Front as shown in Plate 1 of the book, and assuming that the cradle is loaded on the mule front to the rear as shown in the handbook of the gun, it would demand acrobatics of a high order from Nos. 6, 7, 8, 9, to transport the recoil cradle quickly into its correct position.

We will say no more about the drill books, but there is another point that merits almost equal attention, namely, equipment. If our drill books may be described as a little behind the times and incoherent, it would be difficult to find an historical period for the classification of parts of our equipment. Here of course we come into direct contact with the difficult problem of £ s. d. It is often difficult to convince the civilian tax-payer that the money he is so anxious to devote to the beautification of the village town-hall—undoubtedly a laudable object in itself, if all town-halls are as lugubrious and unsightly as those of the writer's experience—might be better expended upon the improvement of the equipment of what we might call our Imperial Police Force.

Nevertheless something might surely be done without entailing any great additional expense, especially in the case of the 2·75″ B.L. Gun. It has been argued, we believe, that a quick-firing gun is out of the question, owing to the extra weight of the brass cartridge case, which would too seriously reduce the number of rounds that could be carried with the battery. The expedient of doing away with the leather ammunition box, which weighs 36lbs.—in other words the weight of three shell—and replacing it by a light wicker frame-work, is too obvious to have escaped detection. It must be the necessity for complete protection from the weather that is the stumbling block. Yet surely something lighter and more portable might be designed to take its place. The present leather box, when well dubbinged and polished, is the delight of every Battery Commander at a gun park and harness inspection, but is it really essential on service?

Another objection that has been raised to the introduction of a quick-firing gun is that the temptation to blaze away one's ammunition too quickly might overcome an emotional battery commander to his own infinite regret in the later stages of a moving battle, for

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with ammunition. To that we can only reply that, having once with a section of 2·75's been engaged in a duel with a section of Turkish 14-pounders Q.F. guns at 2,000 yards range with every advantage of ground on the side of the enemy, we found ourselves incapacitated for a further effort owing to a more permanent cause than lack of ammunition, namely, immobility owing to casualties.

Having proceeded so far we may feel reasonably confident of having set up sufficient opposition to merit a justification of our criticism. It is admittedly easy to criticise and to destroy, but the path of reconstruction is hedged about with many thorns. Yet it is hoped that the following suggestions may serve to show a few loopholes through which we may escape total suffocation at the hands of the monster of National Economy wrongly applied.

DRILL.

There seems little doubt that a nine-man gun drill ought never to be exceeded. The principle of introducing a number 10 to take the place of No. 1 in the various lifts and thus leave the latter free to acknowledge orders, work out corrections, etc., is sound enough in theory, but in practice the tenth man is rarely, if ever, available. Indeed we might even go so far as to say that the eighth and ninth man are on many occasions on service, conspicuous only by their absence. We would, therefore, suggest that the 9-man gun drill be retained as a basis, but that far more attention be paid in Peace time to the practice of casualties.

As regards the detail, we propose to let ourselves be guided entirely by the three basic principles of (1) QUICKNESS, (2) SIMPLICITY, and (3) CO-OPERATION. Taking the last first we see no reason why the drivers should not assist the gunners in coming into action and limbering up in the same way that they are assisted by them on the line of march. It has been objected that the driver must give his whole attention to his mule at such moments to prevent the possibility of a stampede, but whatever we may say from the safe distance of the office table, the fact remains that when under fire the driver would, and does, do everything he can to hasten his departure from the scene of trouble. It is desirable for his own sake, and absolutely essential for that of his mule, whose safety is even more important to the authorities. In the official copies of the 3·7″ How. drill this principle has been definitely adopted, and we may therefore surely adopt it for the 2·75″.

SIMPLICITY is best maintained, (1) by making the even numbers always work on the off side and odd numbers on the near side of the mules, It is easier for a man in the heat of action to recognise the difference between the head and tail of a mule (that may actually be in motion at the time), than to remember where he ought to be when he gets to the gun (2) By making the procedure for both gunners and drivers at Action Front as nearly as possible the same as that for Limber Up; and also by making the drill for the 2·75″ agree as far as possible with the 3·75″ How. At present, for example, the chase mule walks in front of the breech mule in the Order of March with the 3·7″ How. but behind him in the 2·75″.

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once the action has commenced the pack batteries move well in advance with the infantry and are often difficult to keep supplied

QUICKNESS at present—that is if we follow the drill book—is hopelessly interfered with by various numbers having to quit the top loads during Action Front and Limber Up in order to fiddle about with small stores, such as seats, spare handspikes, etc. A large amount of individual effort and ingenuity has been expended upon the subject, and more than once we have been told that "someone has invented a new drill in which everything is done in two lifts." Nevertheless we venture to suggest that, however desirable such an end may be, it is mathematically impossible with the means at our disposal. By carefully adding up the number of men required for each load in the firing battery we arrive at a total of 27 man-lifts (or 26 if you let one man handle the sight box), and, according to our knowledge of arithmetic, this cannot be achieved with nine men in less than three lifts. What we can do, however, is to greatly simplify these lifts by getting rid of some of the irritating minor lifts. This is possible (in the 2·75″ at any rate)—

(1). By carrying the Aiming Posts and drag ropes attached by straps to each side of the rear part trail. They are then handy when required, do not get in the way, and need not be touched unless actually to be used.

(2). By fixing the gun-layer's guard into its socket on the cradle at the order "Prepare for Action," and leaving it there as long as may be necessary. The seats might also be attached to the carriage at the same time, but this is not so satisfactory as they are inclined to rattle and may be a nuisance on a narrow path along a steep hillside.

(3). By removing the attachment for the wrench junction nut from the breech mule to the chase mule and letting the driver unstrap it at Action Front and throw it inside the right gun wheel. Its present position on the breech saddle seems quite unnecessary since No. 2 does not himself remove it—indeed, it is on No. 3's side!

(4). It also seems bad policy to waste valuable time during "Cease Firing." The sight box, shield, and rear part trail might all be loaded up at this time. If in a hurry to get away many valuable seconds might thus be saved, and even if the case were not an urgent one there could be no harm done.

Next, a word as to nomenclature. In the 3·7″ How. drill the cumbrous expressions Front Part Trail, Rear Part Trail, and Recoil Cradle have been condensed into the neater forms of Carriage, Trail, and Cradle respectively. Imagine the amount of breath that this has saved the drill instructor who has to enunciate each of these names some half-dozen times for every performance of Action Front or Limber Up!

For the sake of brevity and clearness the suggested modifications for the drill of each weapon have been shown diagrammatically in the appendix. Finally, we should like to emphasise the necessity for an official "draught" drill for both gun and howitzer. The advantages of draught work are so numerous and so obvious that they need hardly be enumerated, but if it did nothing more than allow one to give an occasional much needed rest to one's top load mules it would be worth all the trouble that we could possibly take over it.

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EQUIPMENT.

We have already hinted that, were money no object, the possibility of improvement in the 2·75″ Gun would amount to hardly less than the design of a completely new weapon. Assuming, however, that we are subject to certain very definite financial limitations, there still remains several small, but none the less important, alterations that might usefully be carried out. We will take the harness and saddlery first, as that is more or less common to the two natures of weapon.

The first, and by far the most important, item that occurs to our mind is that of "Quick Release" Straps. Under certain circumstances, notably for draught work, these are very excellent contrivances, and yet curiously enough it is just in the matter of draught harness that the official handbooks have overlooked their utility. On any other occasion they are a positive nuisance owing to various reasons. Those that are issued with the saddles from Ordnance are so thin and weak that any self-respecting donkey could cause them to snap or tear with scarcely an effort. To a well-proportioned Ordnance mule they are a standing—or more precisely a bucking—joke. Moreover, though they are undoubtedly very handy on coming into action, they are often extremely troublesome in coming out of action, and we are inclined to think that the conditions that may sometimes accompany the latter operation are often the more pressing of the two. Finally, a "Quick Release" arrangement with a thin soft strap, after a little wear and tear, tends to function with inconvenient facility, until in the end the parts simply fall apart after a certain amount of jogging on the line of march.

We would, then, advocate the entire abolition of Quick Release straps for all pack loads and their introduction into the "draught" harness, as suggested by Major Bell in Vol. XLVI of the R.A. Journal. Further, we would suggest the general adoption of good wide thick straps for all "top" loads, secured to the connecting stays of the saddle by a simple loop through a metal "D" at the standing end of the strap. The present method of stitching the straps on to the connecting stay makes it impossible to replace a broken strap quickly on the line of march.

After straps, the most crying error is in the construction of our pannels. The pannels now issued from Ordnance are invariably lined with serge and stuffed practically flush with the top edge of the pannel. This destroys any possibility of an air channel down the centre of the average mule's back, and consequently results in a lot of unnecessary work on the part of the battery saddler. If the pannels were made with the serge sewn on about an inch or two below the top edge—as we believe they were in the old 10-pdr.—equipment all this trouble might be saved.

Our draught harness is another item about the appropriateness of which we feel a little doubtful. Major Bell has already pointed out, in the article mentioned above, a very excellent means of improving the draught attachment, to which we would refer the reader. The actual shafts themselves of the 3·7″How. cannot so easily be passed over. We think that experience will prove, if it has not already proved, that these shafts are not strong enough to be suitable for

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pulling sixteen maunds of metal over rock-strewn paths. If we take a glance back at history we find that draught arrangements formed a very important part of our earliest mountain artillery equipments and were only abolished, apparently, as the result of a Committee assembled in India after the Umbeyla Campaign 1863-4. We cannot help thinking that that Committee confined its attentions too closely to the restricted areas of the N.W. and N.E. frontiers of India.

Now let us turn to the weapons themselves. Here we would again emphasise the extreme necessity for a Q.F. gun, capable of at least holding its own against any continental light field artillery weapon. But, if this be impossible owing to expense, let us at least endeavour to get rid of some of the annoying little gadgets that swarm, like pimples, all over the body of the 2·75″ gun and its carriage. The axle tree clips, for example, might have almost been designed for the sole purpose of getting in the way and being broken whilst lowering the carriage on to the axle; the set screw retaining the breech key could never hope to live more than a few days on service, and even the most industrious and painstaking No. 1 may sometimes find his range drum shedding its intestines about the countryside as the result of the hexagon shaped retaining nut working loose. The 3·7″ How. certainly seems a vastly superior weapon of its kind, but we are not sure that there are not a few possible means of improvement. The draught arrangements for one, and the shield for another. Also a brake arrangement of some kind would be a distinct advantage. The small band brakes used in the 2·75″ are fairly satisfactory and easily manipulated, but we do not agree with the drill book in thinking it essential that they should be put on when in action. It only weakens them and prevents them from fulfilling their legitimate purpose, without adding at all to the steadiness of the gun in action.

That, we think, concludes the recital of our woes, the realisation of which we do not lay claim to as any Heaven-sent inspiration. The above is merely an accumulation of many personal and second-hand reflections upon a subject, the importance of which must be our sole apology for having given vent to them. Many of the suggestions have been imbibed from others, and not a few have been successfully practiced on service. But if the Regiment is to benefit as a whole by these experiences the results must surely be embodied in our official guide-books. It is good for a particular unit to have a quicker and better method of drill than any of the others at a practice camp, but it is infinitely better for the whole of our artillery to be quicker and better than the enemy's in war.

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APPENDIX I.

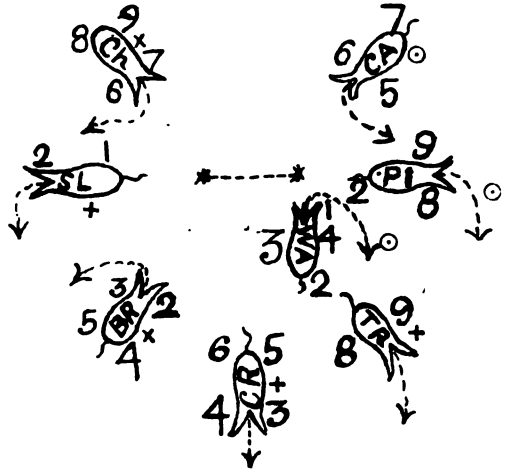
2·75 in. B.L. Gun.

ACTION FRONT.

Notes;—

(a) First Lift shown by ⊙
(b) Second Lift shown by +
(c) In the Second Lift No. 6 doubles from the rear of the cradle to the chase to assist 4 & 5.
(d) The Carriage and Trail mules remain after the Second Lift and Nos. 1 & 3 unload sight box; 4 & 5 the shield; 2 the seats and spare handspike; 6, 7, 8 & 9 ammunition boxes.
(e) Chase mule precedes Breech mule in order of march.

3·7 in. Q.F. How.



Notes:—

(a) First Lift shown by ⊙
(b) Second Lift shown by +
(c) Third Lift shown by X
(d) Detail as in Official Drill Book, except that Chase & Carriage mules have changed sides.
(e) Positions at "Off Sights" not shown.

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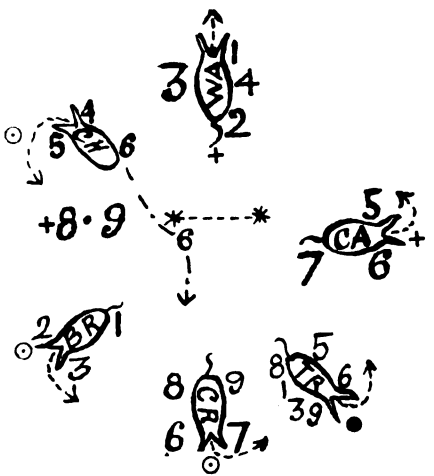
APPENDIX I (continued).

FRONT LIMBER UP

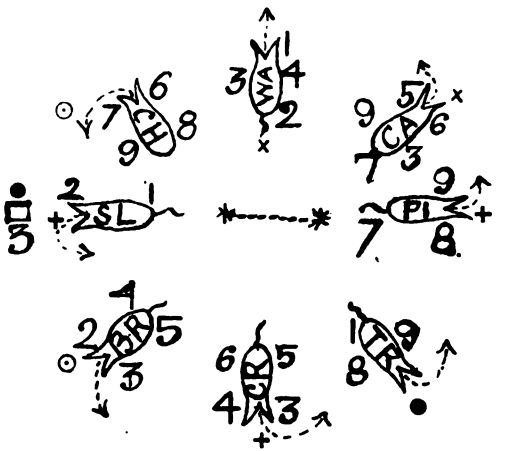
2·75 in. B.L. Gun.



Notes:—

(a) Cease Firing shown by ●
(b) First Lift shown by ⊙
(c) Second Lift shown by +
(d) At second lift Nos. 8 & 9 load the half empty pair of boxes.

3·7 in. Q.F. How.



Notes:—

(a) Cease Firing shown by ● 4, 5, 6 & 7 load the shield.
(b) First Lift shown by ⊙
(c) Second Lift shown by +
(d) Third Lift shown by x
(e) Detail as in Official Drill Book, except that:
1. Chase and Carriage mules have changed sides.
2. Pivot is loaded instead of Trail at Second Lift.
3. 8 & 9 load sight box at the Third Lift.

NOTE:— If the guns were not in action at the time of limbering up the detail shown for "Cease Firing" should be carrried out after the Ammunition boxes had been loaded at "Prepare to Limber Up".

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August, 1920.

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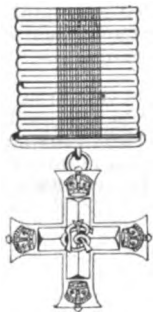

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"DUNCAN" HIGHLY COMMENDED ESSAY, 1919-20.

"The Reorganisation of the Royal Regiment of Artillery with a view to obtaining in war the best value from modern equipments with a minimum of expenditure of human energy."

By Lt.-Col. W. H. Moore, d.s.o., R.G.A.

NON SIBI, SED CUNCTIS.

INTRODUCTORY.

DISCUSSION on Re-organisation is valueless unless based on an investigation into the fundamental requirements from the organisation. Other factors, political, military and personal, either existing or reasonably likely to arise, require to be given due weight. If a lasting settlement is desired, these investigations must be freed, so far as is humanly possible, from the influences exerted by vested interests or personal considerations; no conclusion, however, can be satisfactory which entirely disregards the effect of a re-organisation on the individuals affected.

In dealing with such a subject as Artillery Re-organisation it must be remembered that no one solution will please everybody; and further, that alternative solutions, based on divergent views as to their effect on the human element, may have equal value so long as the fundamental requirements are not thereby endangered.

The best scheme can be wrecked by too much compromise; consequently, if compromise on important details becomes necessary, it is often better to leave matters as they are rather than to upset and unsettle individuals by half measures.

The subject is dealt with in two Parts in this paper; in the first are discussed the principles on which our Artillery Organisation should be based, in the second are indicated the general form which the Re-organisation might take to comply with the deductions reached in the first. The principal conclusions are summarised in the final paragraph of the paper.

PART I.

The requirements from our Artillery organisation remain, as they always have been, to provide adequately manned and fully trained batteries armed with all the various types of guns required

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for Expeditionary Forces which may be employed in any quarter of the globe, as well as for Home Defence; and in addition to this to supply reinforcements for the replacement of casualties among the personnel as they occur.

The more detailed deductions drawn from wars prior to 1914 with regard to the duties of Artillery in the field still hold good, but though principles are unchanged their application has been modified by modern conditions and modern armaments.

In discussing the duties of Artillery and the type of armament to carry them out, endeavour will be made to avoid labouring facts of general knowledge. These facts however cannot be omitted altogether, as they form the basis of the argument developed.

These duties are:—

(1) To support the other arms in attack and defence.

(2) To co-operate in the protection of bases—including Naval Bases—and posts on the Line of Communication.

The principal points emphasised during the recent war with regard to these duties are:—

(1) Artillery is required for both the protection and support of the other arms, and of bases of every description against attacks from the air.

(2) Heavy and even super-heavy Artillery will probably be required to support lighter guns in wars against nations employing the huge armies produced by a system of universal service. The conditions in this respect are likely to remain, since frontal attacks will tend to become the rule rather than the exception in such wars, owing to the widely extended fronts that can be taken up by the great numbers of men available. It may also be expected that the extended fronts will generally be fairly strongly fortified as the time taken by the attack in preparation will be spent by the defence in strengthening to the utmost the line on which the stand will be made.

(3) A greater measure of protection than was anticipated in 1914, may be required for Naval Bases and Harbours of Refuge for merchant shipping, to guard the ships against raids by submarines or small fast surface craft. This protection may remain necessary even when the supremacy of the Fleet is so great as to remain practically unchallenged.

(4) The employment of new inventions, or a return to those long considered obsolete, e.g., gas shells, tanks and trench mortars, must not come as a surprise.

It is unnecessary to go into detail with regard to the armament employed. All types of guns fall into one of three categories:—

(a) Those drawn by, or carried on, horses or mules. Normally firing shrapnel or shells bursting on impact at short ranges. Rapidity in coming into action and ranging being frequently of vital importance. Care to limit ammunition expenditure being consequently at times a secondary consideration.

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(b) Those on fixed mountings, or on heavy carriages or mountings pulled into position by mechanical transport of various kinds, including railway engines. Normally firing shells bursting on impact, or shrapnel at long or distant ranges. Rapidity in coming into action being often unobtainable. Careful ranging to economise ammunition expenditure being nearly always desirable.

(c) Those on fixed, moveable or mobile mountings or carriages for use against aircraft.

These somewhat sweeping generalisations are obviously exposed to criticism, but have the advantage of bringing out salient facts without going into side issues or confusing the arguments with minor exceptions. Anti-aircraft guns of all types are included in the same category, as their rôle, and gunnery problems are similar and entirely different from all natures of pre-war artillery. The equipments and drill of the guns in each of the categories approximate to one another.

If the question of organisation was being considered "in vacuo" it would seem that the Royal Regiment might best be organised in three branches, each responsible for the armament falling into one of the three categories outlined above, as this organisation might be held best to fulfil the conditions laid down in the subject approved for this essay, "with a view to obtaining in war the best value from modern equipments with a minimum expenditure of human energy." In other words it would be an organisation much the same as that existing in 1914, plus a new anti-aircraft branch.

Any discussion of the influence of the political situation on re-organisation is obviously undesirable and out of place in an essay on a military subject. Moreover, the political atmosphere is variable, and deductions drawn from prevailing conditions are an unstable base on which to found any far reaching Re-organisation. The one constant in the problem has been, and is certain to continue to be the difficulty in obtaining money for the upkeep and maintenance of the Army.

It is a matter of common knowledge that it was impossible to get adequate grants before 1914 to fit and equip the Army for war. From the analogy of the years following 1815 it may be expected that this difficulty will be accentuated.

It is unnecessary to make a detailed catalogue of the military conditions that an organisation should fulfil; the following, however, require mention in connection with the subject.

(1) Changes in or additions to, the organisation of the higher formations, i.e., Army, Corps or Division, should not involve changes in the essentials of Artillery Organisations.

(2) Every fit officer or man from the Reserve should be available for service overseas on the outbreak of war, and should for this reason be trained in the work of the Field Army during their period of service.

(3) Every officer or man invalided from the theatre of war should be available, when sufficiently convalescent, to replace men retained in the United Kingdom for Home Defence so as to free the latter for service overseas.

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(4) Complete formations should be capable of being provided within the organisation to meet war requirements, since every task in war should be carried out by a complete unit rather than by fractions drawn from various units, e.g., when a Battalion is required for outpost duty, it is desirable, though obviously not essential, to allot a complete Battalion rather than to find outposts from one, supports from another and reserves from a third.

It has already been stated that the three categories into which Artillery armament fall, indicate the possibility of an organisation based on the types of armament. The only differences between such an organisation and that existing in 1914 are that the Field Artillery branch of the Regiment would include the Mountain Artillery and all horse drawn heavy guns and howitzers.

It is now necessary to consider the organisation on the outbreak of war with a view to reaching definite conclusions as to whether it has given the best results or not, and also with a view to discovering how any weaknesses in it can be eliminated by re-organisation.

The writer has never seen the recommendations which led to the Re-organisation of the Regiment into the entirely separated branches R.H. and R.F.A. and R.G.A. It may however be safely assumed that they were based both on armament and the fact that horse traction was practically limited to the guns of the Horse and Field Artillery, with the idea of getting the best value with a "minimum expenditure of human energy."

The Re-organisation was not, however, carried to a logical conclusion in that guns required to support the Field Army were allotted to the Royal Garrison Artillery.

The reasons for this allottment doubtless were—

(1) As an outlet for the energies of those officers who found themselves on the dismounted list with no particular taste or liking for the routine of Coast Defence work.

(2) As Mountain Artillery had always at that time been almost exclusively used in expeditions on the Indian Frontier, or against uncivilised enemies in broken or sandy countries, it may have been considered unlikely that they would be required to co-operate in civilised warfare with Field Artillery.

(3) As the employment of Heavy and Siege Artillery in field warfare was not considered normal, it may not have been thought essential to transfer the few batteries manned by R.G.A. personnel to the other branch.

The effect of the "split" on the efficiency and personnel of the Regiment is a controversial subject, in discussions on which undue stress is liable to be laid on personal experience or personal predilections. Four at least of its results are not controversial:—

(1) Officers became more settled and contented as on posting they were sent to batteries or companies with whose general fire discipline and drill they were familiar.

(2) A high state of efficiency was reached in the individual batteries and companies, that in the Coast Defence Companies showed perhaps the more marked advance on the preceding period.

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(3) The general standard of gunnery knowledge improved, and its application to practical use increased.
(4) Each branch of the Regiment retained its own less efficient officers, consequently the tendency was to produce a more general level of efficiency amongst the officers in each branch.

The disadvantages of the split, as they appear to the writer, so far as it concerned the officers—N.C.Os. and men were little if at all affected by it—are not likely to obtain unanimous agreement.

(1) Some officers in the mounted branch became inclined to overstress the importance of horses and harness.
(2) Some officers in the dismounted branch developed a tendency to shut themselves away from the rest of the Army, and the majority were given no opportunities during manœuvres of gaining a practical knowledge of the work of other arms in the field.

If the recent great war had not taken place the 1899 Re-organisation could have continued without disclosing its inherent weaknesses as it was capable of providing sufficient men and guns to meet all the demands of war on a small scale. The few heavy or mountain guns outside the Artillery Branch of the Field Army could easily have been manned by personnel trained in field operations under the direct orders of the senior Field Artillery officer. In the case of a war on the grandest scale the neglect of the military conditions that the organisation should have fulfilled at once became apparent, in that,

(1) The addition of Heavy Artillery Headquarters, drawn from the Branch of the Regiment, the majority of which were untrained during peace in field operations, to the H.Q., of a new higher formation complicated the command of the Artillery of the Army.
(2) Artillery required not only to support the other arms but also to support each other had to be manned and also commanded by men and officers drawn from two branches with distinct lists for promotion. It is not surprising that this led at times to a lack of appreciation and want of sympathy.
(3) Officers and men of the R.G.A. reserve were not as such trained or available to act as reinforcements for the R.F.A. The possibility that the R.F.A. reserve would prove inadequate was evidently not considered a likely contingency since, not very long before the war, men from the R.G.A. reserve were transferred to the reserve of another branch of the service.
(4) Officers and men of the R.H. and R.F.A. invalided from the Expeditionary Force were not as such available to replace fit men employed in the Coast Defences.

The only logical conclusions from the above that appear possible are that:—

(1) The 1899 Re-organisation has failed to justify itself in war, and that, notwithstanding any advantages it may possess in peace, it should no longer be continued.

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(2) The whole of the Artillery of the Field Army—omitting for the moment any reference to anti-aircraft guns—should be contained in one organisation, and, as a corrollary to this, that an attempt to base Re-organisation on the academic grouping of types of armament into categories is unpractical.

The next point to be considered is whether the advantages gained in uniformity and tactical training by excluding Coast Defence personnel from the Field Army Artillery Organisation outweigh the disadvantages of losing their services as a potential reserve.

Suggestions for the transference of responsibility for the manning of the guns in Coast Defences to the Navy have been made from time to time. At first sight there appears much to be said in favour of this idea, assuming of course that the Admiralty would be willing to take over the defences.

Coast Defence guns are only mounted to provide H.M. ships with reasonably secure bases, and to assist them in their task of protecting merchant shipping by ensuring for the latter harbours of refuge.

The Admiralty are the sole judges of the probable "Scale of attack" to which a port is considered liable. They are entirely responsible for any patrol service required, and for the identification of ships of war approaching the port. The regulations under which merchant vessels may enter a port require previous Admiralty sanction. The senior Artillery Coast Defence officer has necessarily to work in close touch with the Naval representatives in connection with any questions affecting vessels approaching the port. If these were the only questions to be considered the desirability of handing over the defences to the Navy might be regarded as established.

The fundamental objections to this are:—

(1) It would involve an alteration in the present demarcation of responsibility between the Navy and Army which might introduce competition detrimental to the National interest.

(2) An aggravated dual responsibility might result unless it was also decided to place in war the fixed defences, provided by the Navy under the Military Garrison Commander, or, alternatively, to place the Field Army Garrison under a Naval Commander. In the first place the military authorities might find themselves responsible for defending a port with a fixed armament of whose efficiency or adequacy they may not be satisfied; in the second—it is obviously outside the bounds of practical politics for the Admiralty to raise sufficient field army troops to complete all the garrisons—the naval commander may be provided with a military garrison of whose inadequacy he is firmly convinced. Neither of these alternatives tend to harmonious co-operation, and points of friction between the War Office and Admiralty would inevitably arise.

(3) An increased staff would be required to administer and maintain the garrisons of the fixed defences. This increase in naval staffs could not be offset by corresponding reductions in military staffs.

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These three objections alone are sufficient to show that the drawbacks to *the Army* of handing over the Coast Defence Artillery to the Admiralty far outweigh any possible gain.

The formation of the Coast Artillery into a separate corps does not need discussion, if the conclusions drawn when considering the 1899 division of the Regiment, are accepted. Economy in military administration necessitates its inclusion, no matter what form a Reorganisation may take.

If Anti-Aircraft Artillery is included in Artillery Organisation, its position requires to be determined.

The duty of anti-aircraft guns of every calibre or type is similar —either to hinder the enemy's and to facilitate our own observations, or to protect, so far as possible, troops, bases, etc., from air attack. The type of gun required for the first of these duties must necessarily be lighter than that for the second, in order that it may have the mobility to reach suitable positions in a reasonable length of time. The drill and tactics of both types in their broader lines will be the same as hitting aircraft presents the same problems, no matter what they may be doing. Consequently it would be undesirable to separate types of anti-aircraft guns into two branches, and three alternatives are left:—

(1) To form them into an independent branch of the Royal Regiment, or an entirely separate organisation.
(2) To hand them over to the Royal Air Force.
(3) To include them in the general organisation of the rest of the Regiment.

The general conclusions drawn with regard to the pre-war regimental organisation do not furnish arguments against the formation of Anti-aircraft Artillery into a separate branch, as their duty is in no way connected with that of the remainder of the guns. Undoubtedly it will often be essential that more attention is paid to the prevention of hostile aerial observation or attack on battery positions than to the same when directed on the trenches or bivouacs of other arms, since the neutralization or destruction of the guns might eventually cause the other arms to suffer greater loss than they would from aerial attack. In view of the probable contingency that the number of anti-aircraft batteries required in any future war on a big scale will be very great, it is unlikely that Peace Establishments, even when supplemented by reserves, will provide any surplus personnel. Hence the whole of any Anti-aircraft branch will be fully employed on its own work in war.

Some might go further and prefer to form Anti-aircraft Artillery into an independent Corps, basing their arguments on the idea that an independent Corps would necessarily be more progressive, and that its representatives working exclusively on its behalf would be more likely to obtain funds for its development.

The writer does not share this opinion. Allotment of funds in Estimates is not decided by regimental representatives, but is the result of the collective decision of the Army Council. The policy on which funds are allotted is laid down by the General Staff who are therefore ultimately just as responsible for the development of any arm as they are for its training and tactical theory.

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The two principal objections to both the separate branch and independent Corps are:—

(1) The difficulty of arranging for command in war. Friction would certainly arise in the selection of gun positions, if the assumption is correct that large numbers of Anti-aircraft guns will be a feature in the battles of the not distant future. Friction could obviously be avoided if positions—areas are not practical—were allotted by one authority. The selection of the authority is the difficulty. The General Staff might be trained to do it, but in practice these officers would be too busy, or want of sufficient practical experience would make it unadvisable for them to do so. If the Artillery Commander was made responsible he would in reality become the responsible authority for the dispositions and consequently for the tactical employment of the Anti-aircraft Artillery; this is obviously undesirable if it is to belong to a separate branch of the Regiment, or is an independent Corps

(2) The lack of a reserve other than that produced from its own organization. This might be disastrous as it is easy to foresee the possibility of a situation arising in which the rapid expansion of the Anti-aircraft organization on the outbreak of war would be the matter of prime necessity.

Balancing the possible advantages against the probable disadvantages, the conclusion seems inevitable that Anti-aircraft Artillery should not be formed into an independent branch of the Regiment or into a separate corps.

The same reasoning applies to its transfer to the Royal Air Force; consequently discussion on this point involving expressions of opinion on side issues, is omitted.

The general conclusions drawn from the foregoing paragraphs are that:—

(1) The basis of Re-organization should be the complete amalgamation of all branches of the Regiment in the same general organization.

(2) Organization into separate branches is the simplest method by which in war the best Technical value from modern equipment can be obtained with a minimum expenditure of human energy, but to do this disregards general military requirements and the necessity for economy.

PART II.

War requirements should determine the details just as much as the form of Re-organization. Questions of peace administration and its effects on personnel, however, necessitate modifications if a workable scheme is to be evolved. This has been kept in mind in the alternative schemes considered.

Complete amalgamation hardly needs definition, but it will be well to make it clear that the writer implies by it the placing of all officers on one list for promotion, and the alteration of the terms of enlistment of other ranks to "general service", simultaneously with the

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re-organization. If this step was deferred the general "settling down" of all concerned to the new conditions would be delayed, and the new organization—to use a colloquial expression—would not have a "fair chance".

No proposals are being made for changes in the present Battery or Company Organizations, as minor questions such as the desirability of four or six gun batteries, or the re-organization of Coast Defence Companies into batallions in the more important Defences, or enlarged Companies in the smaller with a view to greater economy in administration are either outside the scope of this essay or of small importance in comparison with the major question of Regimental re-organization.

The necessity for an efficient "chain of command" was recognised during the war by the appointment of higher regimental commanders than the B.G.R.A. of a Division. The necessity of a similar organization is not less in peace; consequently the grouping of unallotted Brigades, Batteries or Companies into some higher organization requires consideration.

Grouping of unallotted units can be carried out by:—

(1) Types of armament manned.
(2) Attachment to the Field Army or Coast Defence formations.
(3) Collection into formations in addition to those for the Field Army or Coast Defences.

If the first of these alternatives was adopted more efficient command could be ensured since the selection of officers with technical efficiency would be facilitated. The objections which make this scheme undesirable, even if the general training advocated in later paragraphs was adopted, are that:—

(1) In war the Heavy and Field Artillery of the Field Army, provided in addition to that maintained in peace for Divisional formations, would come from different groups, thus the advantages of a common training in peace would be lost.
(2) Officers would tend to gravitate to one or other Group and thus the benefits of a general training would be lessened.

In fact the disadvantages of the 1899 Organization would be reproduced, and be accompanied by the heart-burnings resulting from the amalgamation of the separate lists for promotion.

In the second and third alternatives the expression "Field Army Formation" is intended to imply that ALL artillery units allotted in war to Field Army Formations existing in peace will be organized formations under the command of the senior R.A. officer. Argument on this point is unnecessary if the conclusions in Part I are accepted.

The drawbacks to the second alternative are obvious:—

(1) The resulting command in the case of Field Army mobile artillery units would be too large; and, even if a great measure of decentralization was introduced, the commander's time would be absorbed in routine administrative work to the prejudice of his training duties.
(2) It would conflict with the Army organization of the United Kingdom into Commands, as units of the same artillery organization would be quartered in some cases in two Commands.

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The third alternative is the only practical one under existing conditions provided that only unallotted units in any one Command are grouped into a formation. There would then be in each Command in the United Kingdom Artillery groups of varying composition each under its own commander immediately responsible for administration and training. The introduction of a G.O.C. R.A. with a suitable staff on the H.Q. of the G.O.C.-in-C. would provide the link by which the whole would be fused into a real organization.

A similar result could be attained in India by linking the Groups in an Army Command under a G.O.C. R.A., on the Headquarters. In the Colonies so long as the number of Artillery units is small, the senior R.A. officer, while continuing to perform his normal duties, could be attached to the Headquarters of the G.O.C.

For any scheme to produce the results required from re-organization, it must fulfil the condition that arrangements can easily be made and *enforced* for every officer and man to be trained with armament other than that of the unit to which he may be posted. The scheme roughly outlined in the preceding paragraph appears to fulfil these conditions as the G.O.C. R.A. on the H.Q. of the Command or Army can be made responsible not only for the general training of the Groups for war, but also for the training of individuals in the duties of the other branches of the Regiment.

The proviso in the subject of this essay "with a minimum expenditure of human energy" rules out any universal training of officers and men in all branches of Artillery work, even if such a suggestion could otherwise be justified. Variety in training is beneficial and adds to its interest; it widens the outlook and facilitates the introduction of useful innovations in systems which, otherwise, tend to become hide-bound. At the same time too much variety is harmful as it produces the "Jack of all trades" who is "master of none."

Real specialists, that is to say, men capable of advancing efficiency and useful knowledge, are necessary, but all training should be primarily directed towards the making of useful soldiers. Intensive training where limited in scope will in the long run produce no more specialists, using the word in the sense given to it above, than a more general training. The production of so called "specialists" who are highly efficient in certain technical details of gunnery, is largely a question of careful selection of personnel, and of the inducements, financial or otherwise, which this personnel expects to gain.

The object of general training would be obtained if all ranks were thoroughly grounded in the duties and technical details of one type of armament, and received a fair standard of training with a second entirely different type. Officers, especially the more senior, require further training with the third type to fit themselves for the command of mixed Artillery formations in the field. This can be cheaply and practically given, by training Horse and Field personnel on anti-aircraft guns with anti-aircraft batteries quartered in the same peace stations, while Coast Defence Companies could be trained on Heavy, Siege, or Field guns maintained in the Defences as "moveable armament". During manœuvres the Coast Defence and anti-aircraft personnel might be called upon to provide a quota

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to swell the mobile batteries of any type to the nearest possible extent to their War Establishment.

Training alone is insufficient for the officer, and requires to be supplemented by the actual performance of all duties as an officer of the unit in batteries or companies with two types of armament. This training might be repeated twice during the earlier portion of his career, on first joining and again on his promotion to Captain. If considered preferable a satisfactory certificate from a practical gunnery course might be accepted, in the case of a Captain, in place of the second posting. Attachments of officers for instructions to other units are of little value to themselves and are often a nuisance to the unit to which the attachment is made.

The period of training as an officer with two different branches should be for a definite period, say for not less than one year or eighteen months. On conclusion of this period it would be desirable that a practical written examination should have to be passed in the duties of the branch. Examinations of this nature might be held every six months under War Office arrangements, and be substituted for the present Artillery Examination for promotion. Failure to attain a sufficient standard of knowledge could be assumed to be evidence of incapacity to continue serving as an officer.

The confidential reports on the two first postings would be of value in showing to which branch an officer is inclined, not only by inclination but also by temperament.

Though the writer advocates re-organization on the lines of re-amalgamation and general training as essential for the real military efficiency of the Regiment to the Army, he in no way intends to imply that it is either possible, or desirable, to turn every individual to some G.S. pattern, or that advanced gunnery courses are not required. Advanced courses are clearly necessary not only to provide for the higher training of instructors, but also to assist in the formation of the real expert abreast of modern developments in Artillery science, and invention, on whom the Army must rely to prevent any placid stagnation in obsolete methods.

Success in peace administration equally with success in war depends largely on the selection of suitable tools for the task in hand. Selection must therefore determine the branch in which an officer will normally serve, and it rests on the individual to justify his selection for the branch which he prefers.

Success or failure of re-organization on these lines depends both on the co-operation of the regimental officer and on the appointment of a G.O.C. R.A. in each Command at home or similar formation abroad. The latter, in addition to his responsibilities for training, would be the judge on whose opinion the, more or less, permanent postings of officers to branches would be determined, and the elimination of the unsuitable carried out. It is hardly overstating the case to say that the influence on the moral of the Regiment which the G.O.C. could exert might be decisive.

Any discussion on the influence of moral is outside the scope of this essay, but in putting forward a re-organization which may facilitate transfers or exchanges it may not be out of place to lay stress on two points affecting moral.

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(1) As good moral is largely dependent on the senior officers, supersession for promotion followed by early removal is desirable in cases where example and influence is below a necessary standard.

(2) As undesirable officers should be weeded out at an early stage in their career before they are too old to find other employment, definite tours of duty should be insisted upon to prevent undesirables escaping removal by exchanging or being transferred to other units.

At this point reference must be made to suggestions that the Mechanical Transport of Artillery units, and the Communication Service—telephonic and otherwise—required by Artillery Brigades or Higher Formations in the field should be under regimental control. The advantages of the first of these proposals to the Regiment is incontestable, those of the second debatable, since any purely regimental system would suffer when in competition with the Army system.

Moreover, it is clearly undesirable to attempt to obtain special privileges, unless essential for efficiency, which cannot be enjoyed by the other arms without complicating the administrative arrangements of an Army in the field.

In a voluntarily enlisted army of limited size the employment of civilian specialists for corresponding military specialist duties in war, is unavoidable, however disconcerting it may be to the preparation of "Mobilization Tables." Consequently it is inevitable that the bulk of M.T. and Telephone specialists must be drawn from the civilian population on the outbreak of war, preferably from men who have accepted the liability for some retaining fee. This being the case, the training of regular personnel in peace to supervise in war presents difficulties, and may be rejected both on the grounds of expense and also to avoid the introduction of further specialists into the regiment.

The previous portions of this essay have dealt exclusively with the broad outlines of re-organization from the point of view of general military efficiency with special reference to the regular organization in peace; it is now necessary to consider whether the existing reserves required to expand the organization in war are themselves suitably organized and sufficient. In doing so reference to the Artillery of self-governing Dominions need not be made as they do not form a reserve in a strict sense.

The Militia and Territorial Force Artillery in the United Kingdom are normally organized and trained with one type of armament to fit into the general War Organization of the Army; as the time available for their training is limited, it is obviously impossible to train them in peace with a second type of armament. Consequently the re-organization suggested is unsuitable for them. At the same time, their present organization in no way interferes with their incorporation in or affiliation to—the precise word used is immaterial—the organization recommended for the Regiment.

This incorporation need in no way interfere with the separate identities of Territorial units; it would tend to increase their efficiency since the G.O.C. R.A. of the Command, of whose command

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they would be an integral part, would be able to help not only by advice but also by the loan of officers and N.C.O's for training purposes.

The formation of an anti-aircraft branch of the Territorial Artillery at the earliest date is essential. The "Town Guard" theory for manning anti-aircraft armament is hardly a serious solution of a military problem.

If the conclusion is rejected that mechanical transport and telephonic personnel should not be included in the Regiment, it will be necessary to form a reserve of officers and other ranks enlisted for the shortest possible length of colour service and a correspondingly lengthy period in the reserve, or preferably for immediate transfer to the reserve.

In order to assist in the maintenance of a trained reserve of junior ranks the grant of commissions in the reserve for limited periods, during which an allowance or addition to pension would be given, to suitable Warrant Officers and N.C.O's on completion of their terms of service is recommended. This step would probably be not only popular and an incentive to recruiting, but also would provide reliable trained officers of junior rank on the outbreak of war when junior trained officers are most required.

CONCLUSION.

The writer has attempted to discuss the problem without prejudice, and to put forward the main outline of a solution based on military requirements only with due regard to the limitation "with a minimum expenditure of human energy".

In doing so it has been considered preferable to make statements—doubtless insufficiently argued out through exigencies of space—rather than to adopt the constant semi-apologetic attitude produced by phrases such as "it appears" etc. Comparisons with the Artillery Organization of other Armies have been avoided, as no useful deductions from them can be drawn owing to the differences in the conditions to be fulfilled, and the national outlook on questions of Military Service.

The paramount necessity for re-organization is, in the writer's opinion, an amalgamation of all branches of Artillery into one undivided organization.

The form which the minor details of re-organization should take is, as remarked in the opening paragraph, open to various solutions each with its own merits. Numerous side issues open up when details are considered, many of which have great interest and bearing on Organization, e.g., the desirability or otherwise of establishing some form of Territorial connection for artillery groups, provision of drafts, etc. The temptation to follow them up has been resisted, as they do not alter the principles on which it has been argued that re-organization should be based. Some of the points touched on in the latter portion of this essay may be considered to fall somewhat beyond the scope of the subject; should this view be taken, their importance in producing an efficient Organization for war may be held to be an excuse for the writer.

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Any drastic changes in military methods have always aroused opposition either owing to actual interference with individual interests or to the fear that they may ultimately do so. Two examples may not be out of place, the opposition to "the abolition of purchase of commissions" and "the introduction of short colour service accompanied with a period in the reserve", yet now there is probably no thinking man who does not realize that it was owing to these reforms that the British Army was able successfully to carry through the autumn campaign of 1914.

It may therefore be expected that complete re-amalgamation of the Regiment with an obligation to attain a necessary standard of proficiency in more than one branch of its work will probably have opponents. This opposition should not stand in the way if impartial enquiry endorses the general conclusions which the writer has attempted to uphold. Fair adjustments in the separate lists for promotion are difficult but not impossible. Any slight increase which may be involved in Army Estimates as compensation for loss in pensions that might result from these adjustments would be money well spent.

The principal conclusions reached may be summarized:—

(1) Complete amalgamation of all branches of the Regiment in the same general organization, so that any portion of the Regiment with its reserves which may not be required on the outbreak of war, is available and trained to supplement another portion requiring additional personnel for expansion or the replacement of casualties.

(2) (a) *All* artillery forming a part of the War Organization of a mixed formation or Coast Defence should be grouped in peace under the officer who will command in war.

(2) (b) Unallotted Artillery units in a Command at home should be grouped to suit administrative convenience.
(c) A G.O.C. R.A. should be appointed on the H.Q. of a Command at home or similar Organization abroad to command all Artillery groups, regular or otherwise, and to be responsible for the training of regular officers and men with two types of armament.

(3) The formation of an anti-aircraft branch of the Territorial Artillery at the earliest date is essential.

(4) The grant of commissions in the Reserve of Officers to Warrant Officers and N.C.O's, on completion of their period of service with the colours is desirable to augment the reserve of junior officers.

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MOBILE ARTILLERY AND AIRCRAFT.

By Capt. R. Hilton, M.C., D.F.C., R.G.A.

PART I.

CO-OPERATION BETWEEN FIELD BATTERIES AND OUR OWN AIRCRAFT.

FIELD Artillery could be assisted by aeroplanes in many important ways, yet during the war very little co-operation was carried out. There were certainly practical difficulties to be overcome, such as the difficulty of observing 18-pounder percussion from the air, and the inaccuracy in observing time shrapnel.

The shortage of wireless equipment was a great disadvantage. But these were not the real causes of lack of co-operation, for they could have been overcome, as other difficulties were overcome in the case of heavier natures of artillery.

Peace time training will enable us to put right what was lacking between R.F.A. and R.A.F., provided that we acknowledge that it was lacking, and realize the importance of putting it right. There was no spirit of liaison, as there was between the R.A.F. and heavy and siege artillery, though this was in no way the fault of either side. Consequently neither field batteries nor flying personnel really understood one another, and all attempts at co-operation were therefore made on an entirely unsound basis. All that the R.A.F. had to go upon, was its knowledge of the needs of heavy artillery, which was very extensive, but useless when applied to field artillery.

It was inevitable that during the War, the liaison between R.F.A. and R.A.F. should be far inferior to that existing between R.G.A. and R.A.F. Heavy and siege batteries were far more accessible to pilots and observers on "dud" days. Tenders could often get fairly near them, but a visit to a field battery from the aerodrome usually took a whole day. Heavier natures usually stayed in the same sector as the squadron for some time, but field batteries were continually changing. It was possible to ring up a siege battery from the aerodrome, but to attempt to do so with a field battery was a maddening experience.

It is advisable to emphasize the above causes of failure at some length, in order to be sure that such pitfalls are avoided in future. In short, it was not owing to physical or material difficulties that co-operation failed. They can all be surmounted if the right spirit is present, but during the War this was not the case.

In consequence of this mutual ignorance, such attempts at co-operation as were made were based on unsound principles. For

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lack of knowledge of what assistance field batteries required, the R.A.F. tried to adapt for field artillery the system already established for heavy natures. But the kind of assistance which field batteries require from aircraft is entirely different. It would have been scarcely more impracticable to mould co-operation with infantry on the system employed with heavy artillery.

We now arrive at the one essential to good co-operation. Both field batteries and R.A.F. must thrust aside resolutely any preconceived theories based on the established principles of SS 131. They concern heavy artillery, and to drag them into this discussion is to confuse the issue from the start. We can thus approach the problem with an open mind, and ask ourselves:—

"Under what circumstances, and in what way can aircraft assist field batteries?"

The first conclusion is that they will be of far greater assistance in open than in stationary warfare. In the latter, good communication generally exists between R.F.A. and Infantry, the situation is never obscure, at any rate for very long, and batteries have a well defined programme of duties, which they can carry out without the direct assistance of aircraft by means of F.O.O's. In addition, they are continually in close touch with divisional artillery headquarters, from whom they have no difficulty in receiving orders. Ammunition supply is regular and plentiful. Finally, the C.R.A. Division knows exactly where all his batteries are, and is well acquainted with the situation. If a minor operation is to be undertaken there is plenty of time to make deliberate arrangements.

In open warfare, circumstances are very different. The more rapid the advance or retirement, the more obscure the situation becomes; intercommunication breaks down; batteries do not know where the front line is; divisional artillery headquarters hardly know where their own batteries are. A knowledge of the situation becomes more and more essential to efficient co-operation, and at the same time such knowledge becomes difficult to obtain.

In future, open warfare will probably be a matter of even faster movement than at present, owing to the development of tanks and low-flying aircraft. Field batteries will frequently outrun their regular ammunition supply, and the greatest care will be necessary to see that each round is used to the best advantage. This requires still greater knowledge of the situation, to avoid firing on targets of minor tactical importance.

For instance, infantry may in some places, be able to advance without any barrage at all, especially in very rapidly moving warfare. In other places a slight barrage may suddenly be wanted. Strong points may unexpectedly hold up sectors of the advance, and require a distinct minor operation to be arranged at very short notice to prevent them from holding up the entire advance. All this requires:

(1) A continual knowledge of the situation on the part of whoever directs the artillery fire.

(2) A simple means by which the infantry can ask for barrages or special concentrations.

(3) A simple means by which someone who knows the situation

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can turn the whole or any selected proportion of the divisional artillery on to any part of the enemy front line area.

The whole system must be simple and fool-proof, as all systems must, to stand the strain of open warfare. Therefore the principles must be simple and easily grasped by all concerned, and the various signals used must be kept down to a minimum.

The main idea is to keep the R.F.A. informed of what the infantry want. The best judges of that are the infantry themselves, and the best people to carry their wishes to the gunners are the R.A.F. The messages which infantry are likely to want to send gunners during active operations are not more than two—a request for help by fire, and an indication of where that fire is wanted. The means of sending the message from the ground to the aeroplane must fulfil three conditions—it must be easily worked by infantry in or near the front line; it must be unmistakeable and conspicuous to the pilot of the aeroplane, even when being shot at or otherwise distracted; and it must be quick.

I suggest that the infantry should be equipped with a special "signal gun", specially intended for transmitting this message to aeroplanes, and so to their supporting field batteries. It may be said that this would be too great an expense, merely for communicating one particular form of message and no others, but the reply is that this particular message is about the most important in war, and any expense is justified which assists in getting it through. It might be possible so to design the gun, as to enable it to be used also as an anti-tank weapon, if, as seems very probable, it is found desirable to equip infantry to resist tanks.

Each company in the front line would have one "signal gun", which would simply be a device for indicating localities where artillery fire is wanted, by firing at, or about the locality a highly conspicuous form of shell, easily seen and recognised by the aeroplane.

Nothing could be more simple and straightforward than this method, if a suitable gun could be evolved, and there appears to be no reason why it should not.

The gun need not have a range of more than 2,500 yards, since infantry are not greatly worried by enemy further from them than that. It will be normally wanted at ranges of five to eight hundred. It need not be at all accurate, since its object is only to indicate where fire is required, and if the "signal round" falls within fifty yards it will do this satisfactorily. The shell must be large enough to be very conspicuous. A three-inch shell filled with chemical, which gave bright-coloured bursts of various colours (like Verey lights), would be the most suitable kind. The correct colour could be changed secretly at frequent intervals to prevent the enemy from giving false signals. There is no doubt about the visibility at any reasonable distance of a three-inch shell with a burst like a Verey light. It is the quickest and most certain way of attracting the attention of an aeroplane.

The gun would of course, have to be no heavier than other

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infantry equipments, and be capable of being carried by men over any country. There ought to be no difficulty in designing a very light gun capable of throwing a three-inch shell 2,500 yards at 45° elevation. Only one round need be fired each time, so that two dozen rounds ought to last out the needs of a good day's fighting.

Enough has been said (it is hoped) to show that such a "signal gun" is quite a practicable proposition, and the best possible means by which infantry could indicate the locality which they want field batteries to engage. Now let us take an imaginary case to show how the system would work. The advancing infantry in a certain sector suddenly come under machine-gun fire from some bushes and small woods about seven hundred yards to their left flank. All they have to do is to estimate the distance and direction roughly, and fire one round from their "signal gun" at the locality. The gun and its ammunition will be close behind the front line, so that very little time will elapse between discovering the machine gun nest and the burst of the "signal round" somewhere near it.

On seeing the signal, the pilot has to direct a certain amount of artillery fire on to it to enable the infantry to advance again. Sometimes the fire of one battery may be sufficient, at other times several batteries ought to concentrate on the point to do any good, and there are occasions when practically the whole of the divisional artillery should concentrate for a short time on a point to allow the infantry to assault it. Who is to judge the relative importance of the various requests for fire, and decide under which of these three cases each request comes? Who is to select the most important of several requests for fire, in the event of several being made together? The pilot himself must decide all these things. Everything must be left to his discretion.

It is this point about the system which will arouse the greatest amount of opposition among both gunners and infantry. The idea of leaving so much power and such important tactical decisions to the initiative of junior officers of another arm—especially when that arm is no longer part of the army—is naturally distasteful at first. But it is obvious, that unless that trust can be placed in the tactical judgment of the flying personnel working with the army, the whole idea of co-operation is without foundation. After all, the LL call gave pilots a far more serious tactical initiative than this proposed system. The LL call gave them the power to divert all the artillery on the whole front from its normal work in the midst of an operation. In this system they are only responsible for deciding which of several points it is tactically advisable to go for first, and what proportion of the divisional artillery is required at each point.

There is no one in a better position than the man in the aeroplane to decide all these things. He alone has a general view of the whole divisional front. He alone can see from moment to moment, the relative importance of advancing on various sectors of the front. The infantry naturally think that their own particular bit of the line is the most important. Field batteries are apt to think the same about the sector nearest to them. It is impossible for anyone to decide where application of fire will do most good, without a general view of the whole divisional front, and nobody can get that view except the

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man in the aeroplane. It goes without saying that he will have to possess high tactical education and abilities—qualifications only obtainable by practical experience in the field, or by a course for selected R.A.F. Officers similar to the tactical part of the Staff College course. Anyhow, the class of pilot required can be produced in sufficient numbers, provided the Army and R.A.F. work in close liaison to produce them, and much is already being done in this direction.

Suppose the pilot sees several of these "signal rounds" simultaneously, he has to deal with them according to his own judgment. He may decide that at one point the infantry have advanced far enough for the moment, and no tactical good would come of going any further. At two or three other points it may seem from the nature of the ground that there are nothing but isolated machine guns, and a light barrage would be sufficient to continue the advance. On the other hand there may be a strong point holding up the line, and it may be dangerous for the remainder of the front to push on much further till it has been taken.

He must therefore have a choice of calls which he can send down to the divisional artillery, according to whether he wants one battery, a few, or many to engage the locality sent down. But for simplicity, the number of calls must be kept down to a minimum, and to make this possible, certain prearranged orders will have to be issued from time to time by the C.R.A.

The following, for example, might be the recognised procedure for a week or so:—

Map co-ordinates followed by code letters S.P. means that the infantry are held up by a strong point in that locality. Certain batteries named by the C.R.A.'s daily orders would be responsible for answering this call,—possibly two-thirds of the total strength of divisional artillery. The method of answering it would be altered in orders daily. It might, for instance, be a short hurricane "strafe" commencing exactly twelve minutes after the call was sent down, and lasting for exactly three and a quarter minutes, followed by a creeping barrage at a certain (ordered) rate to a distance of 800 yards, where it would dwell for a certain (ordered) time and then die away. All these times and arrangements could be very frequently altered, so that the enemy would never know what to expect, but the infantry, would of course, be informed of the exact duration of the "strafe", the rate of the barrage, and the duration of the "dwell", etc.

The infantry would count (in this case) three and a half minutes from the arrival of the opening rounds and then assault. In order to avoid the remote possibility of the strong point giving way during the twelve minutes' interval, and the danger of our own infantry being there when the "strafe" began, the pilot would fly low over the front line after sending the S.P. call, and sound his Klaxon horn continually. Of course, it would warn the enemy that an assault was coming off, but they would know that anyhow as soon as the bombardment started; and as long as they did not know the duration of the bombardment the knowledge would do them no good and only cause extra uneasiness.

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In short, a complete little local operation against an unexpected strong point could be fixed up and carried out at quarter of an hour's notice by means of :—

(a) One "signal round" fired by the infantry.

(b) One wireless call sent down from the aeroplane.

(c) Use of Klaxon horn by the aeroplane.

(d) Ranging of batteries previously carried out on "Datum" points by a special Ranging machine, and batteries sufficiently registered to be able to switch on to the strong point without further observation.

A whole book would be necessary to discuss in full such a huge subject as this could be if properly developed. The above detailed suggestion, of how the most important of all field artillery duties could be facilitated by aeroplanes, must suffice to illustrate the enormous importance of co-operation between these two arms. It is only one out of many possible uses of aircraft by field artillery. Others, which can only just be mentioned in a list owing to space, are

(1) Situation Patrol to keep C.R.A. and batteries continually informed of the situation by dropping message bags.

(2) Special Ranging Machine to do nothing but range Field batteries on to suitable "Datum" points directly they come into action in open warfare ; battery to call attention of pilot by firing very high bursts over area where it requires a "Datum" point.

(3) Intercommunication machine to keep C.R.A. and batteries in touch with one another during open warfare.

(4) Much greater use of photographs and personal flights by officers of field batteries in order to learn their sector more thoroughly in stationary warfare.

The great thing to keep in mind is that there are enormous possibilities hitherto unthought of for co-operation between R.A.F. and R.F.A. The great essential to exploiting those possibilities fully is to aim at closer liaison than has yet been imagined possible. If such liaison can be formed, the actual system of co-operation is bound to follow.

PART II.

PROTECTION AND CONCEALMENT FROM ENEMY AIRCRAFT.

Experience has shown that two facts affecting the concealment of batteries have to be accepted as inevitable. One is that enemy aircraft cannot be prevented from reconnoitring, photographing and taking action against batteries, however great our air superiority may be. The other is that if a battery stays in one position and

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fires considerably, its location is only a matter of time, however well concealed it may be. This is especially true in stationary warfare, because so many means of location can be put into action against batteries—such as sound ranging, flash-spotters, balloons, and aerial photography. In open warfare location depends almost entirely on detection of flashes or the guns themselves by the eyes of pilots or observers. Instead of occupying a position for weeks on end, as in stationary warfare, batteries may only be a day in each position. For this reason Batteries are less likely to be located in open than in stationary warfare—a very surprising fact, quite contrary to what was previously expected would be the case. However, both in stationary and open warfare, the possibility of being discovered has to be guarded against, and batteries must be not only concealed but protected. That is to say, it must be difficult for an aeroplane to locate the position, and difficult for it to take action, even when it has located it.

Concealment. The art of concealing batteries is a mixture of two faculties—selecting the most suitable surroundings in which to place the battery, and assisting the natural surroundings to absorb the battery by means of camouflage. The rules for guidance in concealing batteries to the best advantage vary according to the nature of the country, the amount of time available, the amount and kind of material available for camouflage, and the probable length of stay in the position. In fact, no rules can really be laid down, because there are no two cases exactly alike.

Even the general principles are so numerous that they would fill quite a large text-book to themselves. There are so many points to be considered—tracks, blast marks, shadows, premature falling of leaves, exposure of the position by snow, mouths of dugouts, carelessness in use and disuse of roads round the position, dumps, and many others. Probably they will all be compiled in a text book —at any rate there is no room in this article to discuss them properly.

But even if a "text book on concealment of batteries" and another "text book on camouflage" were to be published, the most glaringly obvious positions would still occasionally be occupied. If every officer were to read and thoroughly take in the whole of both books, is it likely that he would remember and be able to apply them when selecting a position, especially during the strain of active service? Even if he had both books with him on actice service, he could not read them through each time to see that he had done nothing wrong.

How do animals make themselves inconspicuous to their enemies? Not by learning rules for concealment, but by instinct. Human beings have not got that instinct, but they can easily cultivate it. They have this great advantage over animals, that they can put themselves into the position of the enemy, and get into the way of looking at things from his point of view.

The surest and best way for a battery commander to judge whether his position is properly concealed, would be to fly over it himself at the height at which an enemy machine would normally fly. Unfortunately, on active service, battery commanders rarely have the time or opportunity for doing this. But it is not necessary

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for his actual bodily self to fly over his battery position, as long as he can, by standing among his guns and looking round, let his mental self fly over the position and take a look at it. In other words, if he has flown so often over battery positions that *he is able to form a mental picture of what his own looks like from the air.*

A flying officer of any experience can at once tell, on going into a battery position, whether it is well concealed from aerial observation, even if he has never flown over that locality. Certain things rise up in his mind as an offence against all ideas of concealment—things which might not strike anyone else as particularly conspicuous. It is because he is sub-consciously imagining himself flying over the position, and having his attention attracted by the objects in question. This is the state of mind which should be cultivated in all artillery officers. This is the form our peacetime training should take, rather than the learning of rules and principles.

Similarly with precautions against detection by aerial photographs. It would be excellent if each battery commander could have a photo taken of each position he occupied, and from a study of it could eradicate all conspicuous features. But of course, this is quite impossible. It is quite possible, though, to train the mind so that it can imagine just what any position would look like in a photo. This should also be a part of our peace-time training.

A special course in "battery concealment" could be established, which as many R.A. Officers as possible should go through. Numerous battery positions, good, bad, and indifferent, would be sited in various kinds of country. The course would consist in flying over them frequently, examining photos of them in all weather, and visiting them on the ground. As far as preparation for war is concerned, the cultivation of correct instincts is better than any number of rules.

Protection. What aircraft action must a battery be prepared for, when once it is located? In stationary warfare the aeroplane ranges a hostile battery on to the position, with the idea of making such a mess of it that the battery will have to shift. The protection required is therefore against artillery fire, and is outside the scope of this article. But much can be done to make the task of the ranging aeroplane more difficult. Or rather, careless selection of position can make its task easier. Take, for instance, a country composed of numerous small fields with hedges, and one or two isolated clumps of trees. It would be very hard to range on a battery in one of the numerous hedges, but a battery in one of the small woods is an easy job. This too, could be learnt instinctively by means of the course suggested above.

During open warfare in future, an aeroplane locating a battery will not range a hostile battery on to it, but will probably lead a formation of "ground-strafing" aeroplanes to attack it with machine-gun fire and small bombs. This is only a personal theory, and is discussed more fully in the next part, together with the best means of protection against such attack, as it really comes under the heading of "Artillery attack of Enemy Aircraft."

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PART III.

ARTILLERY ATTACK OF ENEMY AIRCRAFT.

Before the war there used to be a great deal of discussion, as to whether armies should be equipped with special natures of artillery for dealing with aircraft, or whether it would be better to adopt existing equipments, so that all normal artillery in the field should be able to take a part in attacking enemy aircraft. Opinion was very much divided, and no decision had really been reached when war broke out. In fact, if it had not been for the war, no decision would probably have been reached for several years, for at the time no one knew much about the tactical questions affecting the engagement of aircraft by artillery of the field army. For this reason, the discussion had to be based mainly on theory.

Practical experience showed that it was better to entrust a special branch of artillery with the responsibility of engaging aircraft. Special "Archie" batteries were formed, and equipped with guns designed solely for the attack of aircraft. They were not concerned with ground targets at all. Conversely, "normal" batteries were not responsible for attacking enemy aircraft.

This was all very well for some time, but towards the end of the war there were signs that this system would before long be out of date. The reason was the development of low-flying tactics on the part of aeroplanes. As long as machines flew at normal heights anti-aircraft guns could engage them. As the "ceiling" of aeroplanes rose, larger and more powerful guns were required, but only a very small proportion of exceptionally high-flying machines could escape the activities of "Archie" in this way. But when machines began operating at heights of a few hundred feet, no anti-aircraft gun could touch them.

Ordinary batteries, too, were affected by this change of tactics. Previously it had been quite easy for them to carry out the principle of not engaging enemy aircraft. In fact, it was impossible for them to do otherwise, when machines normally worked at seven to nine thousand feet. But when it became quite a common occurrence for enemy machines to cross the lines at less than a thousand feet, it was seen that all batteries not only could, but must, be equipped to engage machines at this height. Machine guns were rightly realized to be the correct weapon for the purpose, and were supplied to batteries.

Thus, changing tactics are causing all batteries to concern themselves in the attack of aeroplanes. It seems probable that in the next war batteries will be compelled in self-defence to devote a great deal of attention to this problem.

The subject of artillery attack on aircraft must therefore be discussed under two distinct heads—attack by proper anti-aircraft artillery, and attack by batteries not really intended for anti-aircraft work. The two problems are entirely distinct, not merely from the points of view of gunnery, equipment, and organization, but above all tactically. For it must not be forgotten that the ordinary battery exists to take part in the land battle—not to shoot at enemy aero-

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planes. This consideration will be a very important matter in the next war, if low-flying machines are used for neutralizing batteries, as it seems quite possible that they may be.

Attack on Aircraft by special anti-aircraft artillery.

This in itself is a very large subject, comprising, as it does, questions of gunnery, equipment, training, organization, and tactics. To deal exhaustively with the whole subject, it would be necessary to have been an anti-aircraft gunner. Otherwise, unless one can speak authoritatively on the ballistic and mechanical sides of the question, it would be an impertinence to give one's opinions. Therefore, I intend to leave that side of the matter entirely alone, and confine myself to tactical consideration, assuming—merely in order to have some basis to go upon—that anti-aircraft equipment will continue to possess the same general nature that it does at present, but with very great improvements in accuracy and shell-power.

That is to say, it is assumed that the weapon will continue to be a high-velocity gun capable of all round traverse and rapid fire, and that the ammunition will be shrapnel, or time-bursting H.E. combined with shrapnel.

What is the general opinion of flying personnel about "Archie"?

It is extraordinarily difficult to get pilots and observers to say what they really think about "Archie". The truth is that no one really knows what they think of him themselves! That is his strong point; there is always a feeling of unknown power about him. It was always a mystery—perhaps some A.A. gunner can explain it—why a certain battery's shooting would for weeks on end be absolutely rotten, then suddenly one day it would develop the most unpleasant accuracy. The following day it would be hopeless again. Others used to shoot only about once every half hour—a group of three rounds or so, often startlingly close. Others would be very accurate over one particular spot. Unfortunately, it was somehow difficult to avoid that spot! "Archie" was in fact an unknown factor, a continual presence with incalculable power to harm.

Yet at first sight, the amount of influence exerted by A.A. batteries, seems almost negligible when compared to that of pursuit aircraft. Cases of machines being prevented from reaching their objective were almost unknown. Cases of machines being brought down were heard of, with incredulous amusement, as if they were a sort of fluke. Pilots were no more chary of undergoing A.A. fire after hearing of such incidents, than a man would refuse to cross Piccadilly Circus because he had heard of the number of people run over there. "Archie" was treated rather as a sort of joke than as a serious contribution to aerial warfare. In spite of this, few pilots or observers could honestly say that they thought nothing of A.A. fire; and usually the more war-flying they had had, the less they thought it a joke in their own minds. Consequently it was the more experienced and more valuable pilots and observers who were most influenced by "Archie", and this perhaps, was about the most important effect he produced—wearing down the nerves of flying personnel by ceaseless and daily annoyances and threats. Many

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pilots and observers had to be sent home for a rest from war-flying as a result of the attentions of Archie; seldom as the result of any one particular "strafing", perhaps, but from the cumulative effect of his subtle and insidious influence working upon them from day to day. As a factor for reducing the fighting efficiency and moral of an enemy air force, even if for no other reason, anti-aircraft batteries will always have an essential part to play in the air over the zone of the armies.

This particular effect they can create to a much greater degree than their rival arm—the fighting aeroplane. The latter may cause heavier casualties, but its effect on the survivors is to increase rather than lower their efficiency and moral. Most flying officers really enjoy a fight, even though they may have "the wind up" at the time. The effect of one or two successful fights is enormously beneficial to the moral.

This faculty of lowering the moral without causing many casualties is, I think, peculiar to "Archie", among all other arms. It cannot be denied that it is of very great value, since it lowers the enemy's effectiveness without his being able to judge how much it has been lowered, as he can with physical losses.

In all other ways anti-aircraft artillery compares unfavourably with fighting aeroplanes. As a means of destroying aircraft—very poor. Only one in fourteen were shown by statistics to have been brought down by A.A. fire. As a means of preventing passage through a certain zone—useless. The only authentic cases of aeroplanes being successfully beaten off by A.A. fire were in some of the raids on London. But at what a prohibitive expenditure of ammunition, and with what a huge concentration of men and guns! Even in this case a couple of squadrons of fighting machines would have done the job much better, now that the problem of fighting in the air at night has been solved.

Up till shortly before the armistice, night was the one time when A.A. guns could engage enemy machines, but our own machines could not. Certain difficulties, which need not be entered into here, prevented night-fighting from being more than a very rare occurrence. Now those difficulties have been overcome, so that fighting machines, and not A.A. batteries, will in future be the weapon for home—and back area—defence against both night and day bombers.

A discussion on A.A. defences at home does not really come within the scope of this article, which is concerned only with mobile artillery, all of which would probably be part of the field Army. But in view of the fact that fighting aeroplanes can do home-defence work better than guns, the idea of tying up any artillery material and personnel in permanent defences at home is wrong. Anti-aircraft artillery will always be an essential part of the field army. Every trained A.A. gunner and every A.A. gun will be needed by the field army. They will not be needed at home, for they would be doing work better left to another arm.

It is a mistake to look upon A.A. guns as a defensive arm, and consider that they should therefore be cut down to a minimum. An arm is only defensive when it cannot come into action unless the enemy does something which he is not necessarily obliged to do. A

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defensive arm is dependent upon the enemy's initiative—for example, coast defence batteries. But A.A. Artillery in the field is just as offensive in its action as any other arm. It is necessary for the enemy's existence as an army that he should possess an air force, and that his aeroplanes should cross the lines and work exposed to A.A. fire. Therefore the enemy has no choice but to suffer from the *offensive* action of our A.A. batteries.

The rôle of A.A. batteries is often considered to be keeping enemy aircraft at a distance—a purely defensive rôle. Surely this is a mistake, for their proper rôle is a continual offensive against the efficiency and moral of the enemy flying personnel—an offensive to which the latter are forced by the nature of their work to expose themselves.

So much for the *cumulative* effect of "Archie" on flying personnel and their work. What is the actual effect on an aeroplane *when doing a job*, and the amount that particular job is hindered or spoiled? A great deal of stress is often laid on the fact that the aeroplane cannot fly straight, but is forced to dodge continually. It is claimed that if the aeroplane can be forced to do this, it is prevented from doing its work properly. It depends entirely on what work it is doing.

It is just as easy to observe a shoot, or locate a battery, or do anything else depending on eyesight, when "stunting" mildly, as it is when flying straight. When bombing, too, provided the bomb sight has been previously set, it is not necessary to fly straight till the last few moments before releasing a bomb. Ordinary photography can be carried out under the heaviest A.A. fire, by dodging about till over the spot and then flying straight and level for a few seconds.

But work which needs extreme concentration of thought is often upset by skilful A.A. fire. The act of dodging is usually quite mechanical, and requires no thought on the part of the pilot, but sometimes the fire is so cunningly directed that it becomes necessary to *think where to dodge next*, to pit one's mind against the mind that is directing the fire. Some batteries used to be able to compel pilots to do this, causing the mind of the pilot to be distracted off his work in hand, and therefore an incomplete job.

Other batteries—perhaps more accurate—might cover the sky with bursts, and yet not interfere with the job. There was no need to think where to dodge, there was no cunningness about placing the next round. So dodging could be quite mechanical without the use of the mind at all.

Possibly in these cases, the battery commander was obsessed with the gunnery part of the problem, and ignored the psychological part presented by the fact that his target was a living being with a will and mind of his own. In other words, he must have worked out perfectly correct calculations for a future position of his target based on the theory of rectilinear dodging away from the previous bursts. If he considered the pilot's mentality at all, he probably imagined that the latter flew in a straight line till a round, or group of rounds, burst near him, then turned *away* from them and con-

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tinued for a certain distance in a new straight line. In practice most pilots did nothing of the kind.

If the opening rounds were any distance from the machine, most pilots would turn directly *towards* the bursts, knowing that a correction would have been made on them, and that the next lot would be anywhere but in the same place. After that they took scarcely any notice of where the subsequent rounds burst, simply estimating the time of flight and never flying straight for more than half that time. The direction of these frequent turns was in no way influenced by any bursts, but simply by the momentary whim of the pilot.

Obviously the problem for the A.A. battery commander must have been very difficult—to decide the future position of a machine whose position depended on no exterior influences at all. It must have been extra hard, when appearances strongly inclined him to think all the time that the pilot was influenced in his moves by particular rounds bursting near him. Perhaps the only sound way would have been to meet aimless dodging by aimless guesses at future positions, uninfluenced by any "probable" changes of direction.

It was not generally realized to what a considerable extent aeroplanes were materially damaged by A.A. fire. A modern machine will stand an extraordinary amount of knocking about, and still keep going. Often the pilot himself may not know of the damage till he lands, even when important struts or wires have been broken. It would have been a great deal more encouraging to A.A. batteries if they could have realized that the machines they engaged seldom escaped without at least some slight damage. Of course during quiet periods such damage was of trifling importance, as the machine could always be made serviceable again next day. But during active operations, when mechanics were kept very busy, and there was a run on "spares", damaged machines were sometimes out of action for two or three days, and the work of the squadron suffered accordingly.

A way in which anti-aircraft batteries can do very valuable work is in co-operation with aeroplanes. The Germans did a great deal in this direction during the war, but it seems that there are numerous possibilities which have yet to be tried.

On the ground it is hard to realize the difficulty of seeing one machine from another at any distance. This is partly due to the great expanse of view exposed to the eye, and the consequent difficulty of focussing the eye on to such a relatively small object as an aeroplane, without any definite back-ground to assist one to do so. It is also partly due to the possibility of enemy machines making use of the sun or clouds to approach unseen, especially when the machine that is being "stalked" is engrossed in its work on the ground. The factor of surprise played a very important part, therefore, in the majority of air fights. It was in this connection that the German A.A. guns were of such assistance to their own machines. It was very difficult indeed to surprise a German machine working on his own side of the lines, or even along the front line. "Archie" would draw his attention by a heavy outburst of fire in the direction of the British formation—not so much with the idea of hitting them,

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as to point them out to the Boche, who thus had ample warning to make for safety. Again, if a German machine was edging near the lines preparatory to having a rush over, there might be a British machine watching him from our side, and keeping behind a cloud in hopes that he would venture over. The German machine might easily fail to notice the British one, but if the German A.A. batteries saw it—which was most probable—their machine would be warned in time. Just as he was about to cross the line a single German round would burst some distance in front of him, and he would turn back at once.

With us, it had to be a strict rule that one occupant of the machine—either pilot or observer—must do nothing but look out for hostile machines. I don't suppose the Germans, thanks to their A.A. batteries, had to waste half the eyes of each machine in this way.

But it was not only in this defensive capacity that A.A. guns assisted his air service. They were used, not only to lure machines further over the lines than it was safe for them to go, but to summon pursuit formations to the spot when one of our machines was over there. Naturally a machine working alone—such as an artillery machine—could go further over the lines when a patrol of our own machines was over there, and we used to look out for opportunities such as this. The German A.A. guns would often put up a heavy "strafe" about three miles behind their lines, making it look as though a British offensive patrol were there. On going over under this impression, an unfortunate artillery machine would find no British machines there at all, but very likely a German formation waiting for him on his way back!

Seeing, as they do, so much that is going on in the air, which those who are actually flying may very likely fail to see, A.A. batteries could make themselves invaluable both to Army and Corps squadrons. The development of wireless telephony, by which they will be able to talk to offensive patrols, and of instruments by which they can detect hostile machines without seeing them, will both lend themselves to valuable co-operation between A.A. batteries and fighting aeroplanes. All that is required to exploit these tactical possibilities is close liaison between the two arms.

A.A. guns, searchlights, location sets, and wireless telephone stations, should all be under one anti-aircraft organization, analogous to the counter-battery organization. Like the latter, its rôle should be a continuous offensive aiming at cumulative effects. This it would carry out by co-ordinating all the ground methods of combating aircraft, in the closest possible co-operation with the aerial methods of the R.A.F.

Attack on aircraft by Artillery not designed for that work.

The reasons which have caused the attack of aircraft to concern all natures of artillery have already been discussed. It seems very likely that, in open warfare at any rate, attempts will in future be made to put batteries out of action by machine-gunning and bombing them. Aircraft patrols cannot prevent low-flying machines from crossing the lines, because a machine with camouflaged upper surface

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is practically invisible against the ground to any machines above it. A.A. batteries cannot engage low-flying machines, so all troops will in future have to protect themselves against this form of attack. This can be done very effectively by machine-gun fire.

As far as batteries are concerned, an important tactical consideration must be kept in mind. The enemy's object in attacking them in this way will be to neutralize them—to stop them from taking part in the ground operations. For this reason, he will try to distract the work of the battery for as long as possible, which time will depend on his supply of ammunition and bombs. Therefore, he will not use all these up straight off, as he would on ordinary troops, but will eke them out with a certain amount of bluff—diving on the battery without firing, etc.

If the battery ignore him, he will drop a bomb or two to distract their attention from their work of supporting the infantry, and immediately they cease this important work the aeroplane will resort to "bluffing" again.

Obviously the degree of success attending neutralization of this kind will depend on—

(a) Length of time aeroplane's supply of bombs can be made to last.

(b) Amount of attention the personnel of the battery pay to the "ground strafing".

It is up to the battery to defeat the aims of the aeroplane by being so well drilled and disciplined, as to be able to carry on with their normal tasks in spite of and throughout the "ground-strafing". It is purely a matter of discipline and training, for the effect of "ground-strafing" on such a target as a battery in action is almost entirely moral.

On some natures of target—such as transport crowded on a road—tremendous material effect is often obtained, but against batteries nothing of the kind is hoped for, as the possible damage is infinitesimal compared with that of shell-fire. All that is hoped for is moral effect—the distraction of the battery from its normal work at an important phase of the operations.

The less notice the battery take of the "ground-strafing" machines the better. Not only will the attacker fail to carry out his mission, but the duration of the attack will be shortened. For the pilot of the aeroplane will use his bombs and machine-gun ammunition up quicker in his efforts to distract the attention of the battery, and the neutralizing effect of a given number of aeroplanes will consequently be diminished.

Drill and discipline will therefore be the true safeguard for batteries against this form of enemy action, but in addition certain steps can be taken which will make the aeroplane's task harder, without interfering with the battery in the performance of its real work.

If a certain definite proportion of the battery personnel are given the duty of engaging the aeroplane with machine-gun fire, the fact of their doing so will not prevent the battery from continuing its normal work. In fact, it will assist the battery to carry on, for

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the moral effect of machine-gun fire will induce the aeroplane to use up its ammunition quickly and go away, and will thus prevent the effective neutralization of the battery. But it is essential that the men detailed for machine-gun work should have no other duties as part of the battery in action. They must be a special detachment, so arranged that the battery is not dependent on their services in action. They can therefore be cooks, batmen, etc., in addition to being machine-gunners, but they should never be gun-numbers, telephonists, etc.

There is no room in this paper to enter into the gunnery problem of machine-gun fire against aircraft, but it may be mentioned that it is a subject which will require special training for the machine-gun detachments of batteries. The value of machine-gun fire against aircraft engaged in "ground-strafing" is far greater than is imagined by most ground troops. Nearly fifty British machines were brought down by this means in *one day's fighting* during 1918, on one Army front.

Another way in which batteries may learn to make the work of "ground-strafers" harder is by choice of position. For various reasons connected with flying, it is most unpleasant to "ground-strafe" positions near trees, villages, and very steep slopes. The moral effect of machine-gun fire is greater when one cannot see the people who are firing, so that batteries among gorse and scrub will be molested less by aircraft—even when seen—than those in isolated patches of cover.

The three great points in the attack of aircraft, by batteries which are not primarily anti-aircraft units, are:—

(1) Battery personnel drilled to ignore the action of "ground-strafers", and to carry on with their proper work in spite of it.

(2) Training of machine-gun specialists in engaging low-flying machines. These men not to belong to gun-detachments, etc.

(3) Selection of position with regard to possibility of low-flying attacks.

Much more has been said about attacking aircraft with proper anti-aircraft batteries than about attacking them with batteries designed for "normal land duties". Some people may think that not enough has been said about the latter. They may point out the tremendous value of machine-gun fire against aeroplanes, and the possibility of field guns engaging enemy aircraft flying low over the front line.

No one admits the great value of machine-gun fire more than I, or more fully recognizes that under certain favourable conditions 18-pounders may considerably annoy low-flying enemy in the front line area. But it must not be forgotten that "normal batteries" have other duties to perform—an essentisal part to play in the land battle. If they divert their energies unnecessarily to the shooting of aeroplanes, the infantry whom they are supporting, will suffer. The question is therefore not how much they *can* engage aircraft, but the minimum amount they *must* do in order to be able to go on with their real duty. The minimum amount of attention that will have to be paid to this subject by "normal" batteries is the amount outlined

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above. Nothing has been said at all about the engagement of low-flying machines with 18-pounders for the same reason. It was attempted during the war, though flying personnel were never worried at all by it. It might be feasible if it were desirable. But the principle is wrong. Field batteries have other more important work to do, and ought not to engage aircraft *except* when interfering with that work.

Aircraft have far-reaching effects on all branches of artillery work. Co-operation with aircraft, concealment from them, attack of aircraft, and attack of batteries by aircraft have all been very briefly attended to in the above notes. But these and many other possibilities of development are too vast a subject for theoretical discussion. Fresh inventions and evolutions are continually giving scope for further aircraft action, which must radically alter our artillery methods. The only way that we can keep in touch with these tactical possibilities is by close and continual exchange of ideas with the R.A.F. Our whole future training ought to be founded on this principle. Personal discussions between officers of the two arms will do more good than all the text-books in the world.

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A HISTORY OF ARTILLERY.

PART I.—ARTILLERY BEFORE THE REGIMENT.

By Ralph Flenley.

(University of Manitoba, Winnipeg, Canada).

(Continued from page 164.)

There is little in the military history of England in the period from the accession of the first Stuart in 1603 to the outbreak of the Civil War under his son forty years later to arrest our attention. The slothfulness born of peace had fallen on the country and the few occasions on which she took the field only served to exhibit the fatal effects of her decline in military efficiency. Safe, or almost so, from invasion, the bickerings and rumblings which preceded the internal war produced no military preparations for it. Cecil complained in 1628 "This nation hath been too long in peace—all old commanders both by sea and land are worn out and few men are bred in their places, for the knowledge of war and almost the thought of war is extinguished". [1] We naturally hear little of artillery in English hands during these years. A document of 1620 gives us the detail of the artillery train to accompany a force of 25,000 foot and 5,000 horse to recover the Palatinate, but the force never materialised. This train was to have had two brass mortars with two chief petardiers and ten attendants, and eighteen cannon, of sizes from cannon royal to sakers, with a master gunner, three mates, three constables or quarter gunners, one hundred and twenty four gunners and one hundred carters, of course with the Master General of Ordnance and his gentlemen, a body of pioneers and the like. The preparation of cannon is rather small.

Yet these same years on the continent saw notable developments in the rôle of artillery in war. It is one of the claims to greatness of Gustavus Adolphus that he realised above his predecessors or contemporaries the value of artillery in the field. In this he succeeded Zizka as Frederick the Great succeeded him. Fighting and marching as he was between the shores of the Baltic and the Danube and frequently storming prepared positions, he had need above all of guns which could be transported easily and brought into action quickly. So we find him, probably learning something from Maurice of Nassau's example in Flanders, carrying in his trains "conducted by the most experimented artists of any in Christendom", a greater proportion of light field pieces called "drakes".[2] These he placed in his battle line between his cavalry and his infantry, advancing them during the battle as at Lützen to cover the infantry attack,

[1] Qu. Firth, Cromwell's Army, p. 11.

[2] Drakes were short guns. A table of 1643 gives them as about half the length of the other pieces of the same calibre.

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or confounding Tilly at Leipsic with their rapidity of fire. He even, for lightness, experimented with "leather" guns—light bronze guns with a leather cover and rings—but these though copied in Scotland a little later, were not strong enough to stand much continuous firing. Yet they show the new importance attached to mobility, and Gustavus can rightly be called "the father of field artillery." Both Scots and Englishmen during the years of peace at home had been fighting in the Thirty Years War and brought back with them something of the artillery experience gained from the great king of Sweden. We see the influence directly and at once or almost at once. In the war which Charles I found himself waging with his Scottish subjects the latter not merely had more and heavier guns—demiculverines against sakers—but their gun factory set up in Edinburgh by Hamilton, who had served under Gustavus, made leather and other light guns capable of being carried on horseback. In the battle of Newburn it was the Scots' artillery which decided the battle by opening a way across the Tyne. The Scotch gunners were well trained if we may trust the chronicler who asserts that in a review by the king next year, their gunners "discharged wondrous swift, but with as good order and method as your skilfullest ringers observe with bells, not suffering the noise of one to drown the other".

This Scottish war was but the curtain raiser to the great Civil War in England. When that began both sides were deficient in artillery, the advantage in this as in other things going more and more to the Roundheads as the war went on. Whilst earlier writers have little or nothing to say about the use of artillery by either side, the greatest living authority on the period concludes that the artillery "played a much more important part in the Civil War than is usually supposed".[1] The use of cannon and mortars in the siege operations which formed so notable a part of the war, was as we should expect to find almost universal. The siege cannon of the day were the cannon (60 pounder) demicannon and culverine. At least as important however were the mortars with their shells. We find Cromwell using 15 inch mortars for the siege of Pembroke, and 12 inch mortars were included in the train of the New Model army. The task of the besiegers' artillery was to blow breaches in the walls for the stormers, but frequently, as at Winchester where "the battering guns made in a day a breach wide enough for thirty men abreast to enter" the fortress surrendered by the work of the ordnance alone. In addition to the larger and more important sieges such as those of Gloucester, Reading and Bristol, both sides alike used cannon against the walls of the fortified castles and country houses all over the country in the local fighting that went on against Sherborne Castle, Basing House, Devizes Castle, Lathom House and many another. It was for many of these houses the first and last occasion on which they were subjected to artillery fire, the fame and even the marks of which have endured to our own day.

It would be interesting to follow these siege trains as they lumbered about the country on their heavy carriages, drawn by oxen very often, with their ammunition and barrels of powder on

[1] Firth, *op. cit.*, 149.

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carts behind them, the gunners walking alongside or mingling with the escort of infantry which accompanied the train in part to see that the civilian drivers did not desert with their beasts. We have a contemporary newspaper account of the way in which Fairfax disposed his cannon on the march in 1645. "Between every Regiment is drawn four pieces of ordnance, and four the next and so all through the army . . . . the carriages and train is drawn in the middle of the army between the regiments and the pioneers, who march before the train and make way as occasion serves, some of the pioneers also going in every place with the ordnance." Or again one would like to see them in action, each gun with its crew of three men, one of them filling the long handled ladle from the open powder barrell to lower carefully down the gaping muzzle of the piece (it was a 'foul fault' if a gunner failed to withdraw his ladle clean and empty of powder), putting in the shot and wads, 'guageing' their piece and finally firing it and watching the shot rise by the '*motus violentus*' and then fall by the '*motus naturalis*' as depicted in the illustrations and gunnery text books of the time. As to hitting a target, the author of one such book lays it down that "to fail at the first shot is passable; and at the second time to fail is pardonable, but to fail of a fair shot at the third time is too much and argues but little judgement and discretion in such a gunner". It all depends on the conception of a fair shot. Often it must have been a fair extent of wall or tower. The usual range seems still to have been two or three hundred yards but must sometimes have been greater. A range table of 1646 gives us the extreme range of the culverine, an 18 pounder for example as 2650 yards. There was by this time a regular drill for gunners, with thirteen words of command, from "Put back your piece" to "Guage your piece". The gunner of the Civil Wars was exhorted to "set himself forth with as comely a posture and grace as he possibly can, for the agility and comely carriage of a man in handling his ladle and sponge and loading his piece is such an outward action as doth give great content to the standers by". There was however another side to the picture in the eyes of at least one Puritan writer, to whom the comely and graceful attitude of the gunner was liable to be marred by a propensity for strong language and negligence of godly fear.[1]

[1] "Many times," says the author to the light to the Art of Gunnery, "it falleth out that most men employed for gunners are very negligent of the fear of God. Many examples of this nature might be alleged and produced from the experience of preceding times but I thought fit to intimate only this one for the terrifying of all Godless and the confirming of all Godly gunners. In the year of our Lord 1631 in the month of April there was on the island Nero a gunner whose name was Cornelius Slime, but a very Godless and profane man who at no time could speak but he would be cursing and swearing, and when any would ask him what was his hope when this life was ended: his answer was, it may be to Heaven and it may be to Hell; but, said he, if I do go to Hell there I will sell tobacco and brandy and that would be good medicine for the Devils. But one day this Cornelius Slime in the presence of my author and many more, being cursing and swearing and many times giving himself up to the Devil; in the meantime, in the presence of all those people, the Devil lift him up in the air and let him fall to the ground with a great noise; but the second time being caught up by the Devil he was taken where never living man could find him. From the like the Lord deliver us all. But if experience had not taught me what the lives of many gunners are, I would have said nothing of it here." Qu. by Hime, Min. of Proc. R.A.I. 1870, vi.

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Without wishing to identify this in any way with the siege artillery of the time, we must turn to say something of the more purely 'field' work of the guns of the period. Not merely do we find in the Civil War a marked advance in their share in operations, but we may note the definite establishment of the close connection of these light guns with the infantry. The 'battalion guns' may almost be said to date from this time. "In contemporary accounts of battles there are indications that the practice existed both in the army of the Earl of Essex and in its successors", says the historian to whom we have already referred. Whilst the culverine and demiculverine were used in the field, the 'saker' a five or six pounder and the 'minion' or three pounder, were more properly "field" guns. These required three to five horses to draw them, could be fired at the then rapid rate of fifteen rounds an hour and had a maximum range of about two thousand yards. The normal point blank battle range was of course very much less. In the search after increased mobility experiments were made with even lighter guns. Both the leather guns and 'drakes' already referred to were used during the war, the latter as most used being apparently a short or light three pounder. Colonel James Wemyss a Master Gunner of England and very interested in the art and practice of gunnery, accompanied Sir William Waller in the capacity of "C.R.A." in 1643. Waller had what was essentially a field force and Wemyss took with him certain light leather guns "very easy and light of carriage. One horse may draw a piece which will carry a bullet of a pound and a half and do execution very far." We cannot follow the gallant colonel in his advertures or further experiments, which make him one of the most interesting gunners of the century. At Cropredy Bridge the Royalists captured along with him, sakers, minions, and two "barricadoes drawn on wheels, in each seven small brass and leather guns charged with case," guns of Wemyss' invention.[1]

Normally both large and small forces on both sides carried artillery about with them. Occasionally they had none as the Scots at Preston in 1648, and Cromwell, in haste to meet them, left his own train behind. But at Edgehill, at Newbury, at Marston Moor, at Naseby, at Langport, the artillery played a part of varying if not yet decisive importance. At Edgehill where king and rebels were about equal in artillery through the fact that Essex's train "destitute of all things necessary for motion" as a contemporary put it, was not up in time, the guns of both sides opened the battle from the flanks of the armies, those of the Round-heads, so their chroniclers asserted, firing more rapidly and doing more damage than the Royal guns. But once the two sides had joined battle, the artillery became the almost defenceless object of cavalry attack from either side, to be lost, rewon and lost again as the tide swept over it. Royalist guns were 'nailed' or spiked by the Roundheads, and draught harness cut so that they had to be abandoned. In the end however the king's men captured four of Essex's cannon. At Newbury in the following year, very light guns of the Parliamentarians, 'battalion guns' we can almost call them, had to withstand

[1] There is an account of Wemyss by Dalton in *Min. of Proc. R.A.I.* XXIV. 1897, p. 121.

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both the preliminary bombardment and the cavalry charges of the Royalists before the heavy artillery came up and turned the balance in their favour, doing "very great execution upon the King's party both horse and foot" says royalist Clarendon. At Marston Moor the guns played little part; at Naseby hardly more though the Roundheads by this time had a larger and better organised train, that of the famous New Model army. Unfortunately we have no detailed account of this train, which had more to say at Langport in the same year 1645, when it did "great execution upon the King's Party both horse and foot . . . . forcing them to draw off their ordnance and their horse to remove their ground" says one Puritan account. By its fire the Parliament party's artillery cleared the way for the advance of both horse and foot. Whilst Cromwell cannot be claimed as a great artilleryman he showed clearly enough in his Scottish and Irish campaigns of 1650 that he appreciated its value. Against Scotland both on the march and at the battle of Dunbar he used his guns to assist in counter-balancing his inferiority in numbers, for he had 16,000 men against 26,000. His reward came with the capture of the whole of Leslie's artillery after the battle of Dunbar. In Ireland the train which he was careful to take with him was of enormous value in the reduction of the country, though that was of course in sieges such as those of Drogheda and Wexford. Though we are still sixty years from the Regiment, the names of such men as Alexander Hamilton, James Wemyss and Sir John Merrick, the last of whom commanded Essex's artillery at Newbury and elsewhere, can hardly be omitted from any list of British gunners.

We do not expect to find, nor do we find, very marked artillery developments during the times of the restored Stuarts. The mind, the hand, and the need which had made the army of Cromwell's rule 'the finest force in Europe' were gone. And although Charles II retained some of the results of the Commonwealth experience, above all as everyone knows in founding the standing army which has grown from that day to this, the absence of land war or warlike expeditions inevitably tended to produce a cessation, if not more, in the growth of the arm. This was of course helped by the lack of regimental organisation which left the gunners in the different garrisons isolated units, not united in any way, often in fact drawing their pay as gunners whilst engaged in a trade in the town, the post of gunner being bought and sold like any other place of profit under the Crown. The most important of these groups was of course that at the Tower. In 1670 there were over a hundred gunners on the pay roll there. Three years later they are referred to as a 'company' of artillery. In 1682 an attempt was made to improve their training and discipline. Their number was reduced to sixty, their pay was fixed at one shilling a day, and they were to be regularly drilled by the Master gunner once a week in winter and twice a week in summer. On the other hand they were to be protected in part from excessive mulcting in the way of fees. Duncan[1] sees in this reorganisation a "landmark, proclaiming that a nucleus and a permanent one of a trained and disciplined artillery force was a necessity." It was from

[1] History of the Royal Artillery, i, p. 61.

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these gunners in the Tower and elsewhere that the personnel required for trains of artillery, both of the heavy and light guns was drawn. In 1686 for example when James II assembled a force of 1300 men to overawe the capital, gunners and 'matrosses' were attached with each pair of the light three pounders allotted to the seven regiments of foot. It was a clear recognition of the system of battalion guns which, expressing the rightly close connection between field artillery and infantry, was to remain without modification long after its usefulness had departed and it had become a check and a hindrance to the development of a mobile field artillery. Yet there is something to be said for it in its inception, before there was any regiment of trained gunners.

Both Charles and James had some reason to be interested in the army they had created as a guarantee for their rule, and it is usual to credit Charles with some interest in the scientific development of his time. It is, as we should expect, from this period that we are able to talk of a military science with accuracy. With the substitution of the firelock for the matchlock, the growing use of cartridges, the abolition of the clumsy rest for the musket came, most important of all, the bayonet. It was inevitable that what was to be the most scientific of all arms should feel the influence of the general growth. We see a certain amount of royal interest in guns and gunnery. Dryden in his Annus Mirabilis (1667) relates how,

> "Our careful monarch stands in person by
> His new cast cannons firmness to explore:
> The strength of big-corn'd powder loves to try,
> And ball and cartridge sorts for every bore."

Pepys and Evelyn testify to the more general interest in such matters. Pepys tells how in 1669 he went by invitation to see a new gun tried at 'the old artillery ground', and Evelyn how "I saw a trial of those devilish, murdering, mischief-doing engines called bombs, shot out of the Mortar piece on Blackheath. The distance that they are cast, the destruction they make where they fall, is prodigious". The siege experience of the Civil wars and the value attached to the 'bombships' had indeed led to an increase in the number and sizes of bombs made in this period. A list of the time gives us no less than thirteen sizes from 18½ inches down, all save two of brass: one of the largest calibre was used in the siege of Londonderry. Shortly after the Restoration a new officer, the Chief Firemaster appears, whose duties, defined in 1683, were parallel to those of the Master gunner, though he was concerned with mortar makers and workers. In 1686 came a Chief Bombardier and twelve bombardiers at two shillings a day, to be specially skilled in the use of mortar pieces and to accompany their 'bombs' on land and sea. They were closely associated with the Petardiers appointed about the same time, though their title has lasted longer.. We hear of Woolwich in this period. Batteries were built there, Pepys tells us, when the Dutch fleet was in the river in 1667. Next year the ordnance stores from Deptford were moved there. A few years later we find an "estimate of a storehouse to be set up at Woolwich for receiving fireworks". The saltpetre stores and more cannon from the

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Tower wharf, were moved there shortly afterwards. By 1680, with the growth of the city, as of the number of guns and mortars cast, the proof of guns was carried out at Woolwich instead of at Moorfields. Before the end of the century the Laboratory establishment, not called the Arsenal until the nineteenth century, had found its way there from Greenwich, and the explosion of 1716 helped to send the Moorfields gun foundry to the same place.

Not the least important changes affecting artillery during these years came on the administrative side. Whether the abuse of the Ordnance department for lack of preparation, following the appearance of the Dutch fleet in the Medway, was justified or not, we find a good deal of attention paid to its affairs in these reigns. Duncan[1] attributes this and the improvements which it brought about mainly to the efforts of Colonel George Legge, Lord Dartmouth, Master General of the Ordnance from 1682 to the Revolution, but behind him we may perhaps discern the figure of James then Duke of York whose military capacity was far beyond that of his brother. Many of the elaborate Instructions and Orders issued at this time are printed in Cleveland's pages. They include the issue in 1683 of the detail of the 'proper duties' of all the Officers of the Ordnance, the clerks, the storekeepers, engineers, master gunners, firemasters and the like. Following this comes an 'establishment' of the pay roll of the Ordnance, and amendments to the Instructions. Whilst we cannot say that henceforth the Ordnance department was free from abuses or deficiencies, there is nothing to gainsay the conclusion that "before the end of the reign of Charles II the Ordnance had become one of the best organised branches of the British Army."[2]

The military operations of this period are negligible and we cannot linger over them. There is nothing of special interest to us in the siege of Tangier, and the fight of the west country peasantry with their overplaced trust in Monmouth against the royal troops at Sedgemoor is not very notable as a military operation. As it happens we have a fair amount of information about the artillery engaged in the battle since a Mr. Edward Dunmere who served in the train, has left us his journal,[3] the first gunner journal of a campaign, and according to Macaulay the best source for the events of that ill-fated adventure. His account, it must be confessed, does not fill us with either confidence in or admiration for the artillery train of the day. Guns and gunners played no part in the change whereby the last of the Stuart monarchs was succeeded by William of Orange. So far as England itself was concerned, a bloodless revolution, it nevertheless was to give the country nearly a score of years of fighting in Flanders and elsewhere, resulting, one of many graver consequences, in the founding of the Royal Regiment. The enforcement of the Revolution settlement on Scotland does not concern us: the wild rushes of the Highlanders at Killiecrankie and Dunkeld were neither supported nor opposed by artillery fire for the simple reason that neither side had guns with them. In Ireland the case was different though space is lacking to describe the artillery

[1] *op. cit.* i, p. 48.

[2] Clifford Walton, *History of the British Standing Army*, 1660-1700, p. 722.

[3] The Journal has been printed in Mins. of Proc. R.A.I., XVIII, 1891.

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work of the campaigns which ended at Limerick. The increasing commonness of light guns in field operations was shown at Newton Butler, where two small forces met, both with artillery, the Irish gunners, to their credit, being cut down at their guns ere defeat overwhelmed them. The three and a half months siege of Londonderry 'the most memorable in the annals of the British Isles' has been described once for all. Since Londonderry was not simply a fortress but a residential town, the damage done by the guns and mortars of all calibres up to 18½ inch in three and a half months was considerable. Yet so far as artillery work alone is concerned its effects were not decisive nor does the siege compare with that of Namur by William a few years later, when he surpassed all records for artillery fire, and this in a country more used to sieges than any in the world. At the Boyne the guns of both sides were immobile or nearly so, from the nature of the ground, the low bottom of the Boyne. The bombardment which went on—it must have been very intermittently—all the day before the battle does not seem to have affected the result very markedly.[1] And in the drawn out campaign that followed there is nothing to delay us. It was not, happily, in Ireland that the lessons of artillery were to be learnt.

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To-day as in Uncle Toby's time, Flanders is a household word, and it need not disturb us that the connotation is a little changed. It was a muddy country then as now, whose roads could be impassable in full midsummer, whose sluggish rivers had to serve instead of the modern railway for heavy transport. It is tempting to compare the guns and gunners of William's and of Marlborough's day with those of our own, as they fought over the same ground, but space forbids. One general difference in the country itself we may note. Flanders was then far more than to-day a country of fortified towns. From Ypres to Liege, from Antwerp to Mons and beyond it presented the appearance of a series of places fortified more or less strongly, to be garrisoned, besieged, won or lost as the fortune of was ebbed and flowed. Mr. Fortescue remarks on the French weakness for siege warfare at this period, and Vauban's works, to say nothing of the record of the "ravelins, bastions, curtins and hornworks" which Uncle Toby and Corporal Trim set up in their garden, may serve to remind us of the large share which siege operations had in the wars of the time. It was inevitable that when William 'took England on his way to France' he should take British troops with him. They did in fact precede him in 1689 but it was not until three years later that a British force of any size crossed to the Netherlands. The allied artillery had rather more than its intended share in the fighting of the battle of Steenkirk though it must have done a good deal of damage to the French army caught all unready for battle ere in the retreat before the pressure of Luxembourg's superior numbers, ten guns were lost. That was artillery in attack. In the following year at Landen or Neerwinden, William had one hundred guns lining the entrenchments behind which with fifty

[1] History might have been changed had the attempt to 'snipe' William III with a 6 pounder as he sat at breakfast on the day before the battle succeeded.

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thousand men he faced the attack of eighty thousand, with a less number of guns. Culpable lack of provision for retreat led, after Neerwinden had fallen to the pressure of superior numbers, to the loss of eighty guns, a train in themselves, some of them to be recovered years afterwards. Next year saw a fresh train of sixty guns and six mortars cross to Flanders, organised it is interesting to note, in four companies of one hundred men, each under a captain, the whole being under a Colonel, and complete with kettle drum and coachman. It is the next year before we find this train at work at the siege of Namur, Vauban's and Cohorn's masterpiece, which fell, outworks, town and finally citadel in turn, with a noise that reverberated through Europe. It was a great blow if only to the pride of Louis XIV, and an achievement the siege gunners even of to-day may take a pride in. In the exiguous peace establishment which followed the Peace of Ryswick, we may see a definite step in advance four companies of artillery were retained at about one third their strength of one hundred.

The war which brought the next stage was not long in coming. The terrain was much the same but the scale was larger and the results more glorious. What mattered most in this war was that William was succeeded by Marlborough, perhaps the greatest of British soldiers ever to fight in Flanders. The fame of his battles has rather overshadowed the other parts of his fighting there. Everyone knows Ramillies, Blenheim, Oudenarde and Malplaquet, but many of us have forgotten his great siege and capture of Lille, and few of us remember his capture of Liege, or Menin or Ypres, or his breaching of the successive trench lines, the French built to stop him. We cannot follow Marlborough or his trains as they marched or floundered along the roads of Flanders, or sailed lazily up her turgid streams, nor yet in his great stroke at the Danube. That without being in particular an artilleryman, Marlborough was fully alive to the value of the arm is easy enough to illustrate. He was throughout his campaigns, Master General of the Ordnance, but he had an interest in artillery far beyond that of its official head. He showed it not merely in sieges as his letters, for example those of 1707, amply testify, but he used his guns in his battles, and that under his own direction to a greater extent and with greater effect, than any British general before his time. To the latest and best historian of his campaigns he "was never greater than as an artillerist".[1] It is a matter for just regret that the Regiment was made after and not before his wars.

Of Marlborough's trains we need not say a great deal. When he took the field in the first year of the war, he had with him two companies of gunners and fiftysix British guns, many of them, to judge by the work of that year, heavy guns or mortars. His train had grown by the following year, in part by the addition of two new companies of artillery with forty guns from England, so that for the siege of Bonn he had one hundred guns with thirtysix large and no less than five hundred small mortars. How artillery trains were increasing at this time we may see from the fact that in 1706 a force of 11,000 men had no less than fortysix guns, twenty of

[1] Fortescue, *History of the British Army*, i, 589.

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them 24 pounders, and sixty small cohorn mortars. Marlborough's most famous train was that which he used against Lille in 1708. It was no small task to get it there from Brussels, since the French held the waterways. It consisted of a hundred siege cannon, sixty mortars of calibres up to 15 inch, and over three thousand ammunition waggons, requiring with the baggage 15,000 horses and covering fifteen miles of road. It escaped French attack en route however and arrived in front of Lille, it was boasted, without the loss of a wheel. By 1710 the allied train was still larger: for the siege of Douai Marlborough had two hundred cannon and mortars, including eighty 24 pounders. The organisation of these trains is not entirely clear. By 1703 there were in Flanders four companies of artillery, with a Colonel and a Lieutenant-Colonel, each company about a hundred strong all told. But the strength of the companies must have varied as did the size and number of their guns; we can draw no line between siege or field, train or battalion guns as yet. Though the amount of artillery in Flanders increased, it is not clear to what extent the companies grew in size or numbers, the difficulty in part arising from the fact that all artillerymen were not yet organised in companies. Before the peace we have first and second Colonels and Lieutenant-Colonels for the Flanders train, though this may have included engineer and supply officers.

Marlborough with his more modern aim of seeking out the main field army of the enemy for attack and destruction marked a reaction against the French emphasis on sieges. Yet fighting mainly in a land of fortified towns and citadels, he necessarily spent much time and energy on siege work, using 24 to 12 pounder guns and 5, 8, 10, 13, and even 15 inch mortars, with howitzers and petards as well. Not all of them of course were British, though these and their gunners had a share in the capture of the score or so of towns and fortresses taken between 1702 and 1711. Beginning with Venloo and the line of the Meuse to Liege in the former year, almost every campaigning season, with the exception of the one taken up by the march to the Danube, saw the reduction of one or more fortresses of note, Bonn and Huy in 1703, Ostend and Menin in 1706, Lille two years later, Tournai and Mons the next year, Douai, Bethune, Aire and St. Venant the year following. Bouchain in the last year of the fighting. That of Lille, undertaken against Marlborough's wishes, was the most outstanding; the captures of Douai, Menin and Tournai were hardly less important from a strategic point of view; the sieges of Lille, Menin and Tournai were probably the most difficult. We cannot linger over the detail of these sieges. Nor need we do more than mention in passing the breaching of the trench lines which Marlborough accomplished, that from Namur to Antwerp in 1705, that from Bouchain past Arras to the sea, the famous *ne plus ultra* lines, in his last and not least famous campaign. There is the less need to stop at these since in neither case did Marlborough force them by the siege methods and massed artillery fire now familiar to us all. Surprise at a carefully chosen and weak spot gave him the entry, the share of the artillery being almost negligible in both cases.

Of Marlborough's four great battles, two, Blenheim and

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Oudenarde, were fought under circumstances in which we might expect artillery to play a comparatively minor part, in the one case from difficulties of transport, in the other from the nature of the battle. Of Oudenarde this is true. Cadogan's advance guard of sixteen battalions had its light guns, probably 3 pounders, which presumably gave some account of themselves. But not only was the ground on which the engagement took place both difficult and enclosed and the battle fought, so far as the British were concerned, at the end of a march of fifty miles in two days, but the irregular and informal nature of the conflict in which battalions were pushed across the Scheldt and into the fight as soon as they arrived, further contributed to reduce the possibilities of artillery work when a really mobile artillery was lacking. A brigade of horse artillery would have been of inestimable value to Marlborough that day. The French seem to have made no greater use of their artillery; one account says that only six pieces of theirs were in action. At Blenheim four years earlier, not of course a Flanders battle at all, the case was indeed very different. On the famous march down to the Danube 38 pieces of artillery, four of them howitzers, accompanied the infantry. From Mainz the train had to march over hilly and difficult country, with roads bad from rain and mud. To its no small credit it arrived complete, to have ten more guns added to it by Marlborough's German allies. It was of course too light for siege work as Marlborough regretted for Donauworth and Munich. But at Blenheim it played a part at least commensurate with its weight. It arrived in camp after a twentyfour mile march at dawn the day before the battle. The French and Bavarians under Tallard opposed ninety pieces to Marlborough's fortyeight. Further as the French army was in position and on the defensive, whilst the allied army had to march some miles and cross a stream to the attack, their artillery could be placed with care to protect Blenheim and cover the main high road along the river Danube, as well as to open fire on the advancing masses of the allied army. This fire it was the task of the British artillery to check during the long wait from 8 a.m. when the French guns opened, to midday or after while Prince Eugene's forces were working their way forward on the allied right, and the main body under Marlborough lay exposed. The Duke himself saw his guns into position, observing the fire of gun after gun as they opened on the French artillery and troops. Without attempting at all to follow the course of the attack we can yet note the further use by Marlborough of his artillery. Observing that the troops attacking Oberglau in the centre were in danger of being swept back over the hard won crossing of the Nebel, Marlborough advanced some of his artillery to cover the crossing and the advance of the reinforcing infantry, which it did. He followed it up by advancing more artillery to assist in the further weakening of the French centre before the body of the allied cavalry swept forward and cut the whole French army in two, dissolving it in a retreat and rout which left as part of the spoil practically all the French guns and a number of mortars as well.

Ramillies, Marlborough's next great battle has far less interest to the artilleryman. The guns of both sides opened about 1.30 p.m.

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but the infantry attack on the right and centre of the French line was not long delayed. To them and to the cavalry who worked round the French right the victory was due, to the latter in especial the rout which left fifty French guns to be gathered in by the victors. In contrast with Ramillies, the battle of Malplaquet three years later was an attack on a prepared position which, naturally strong, was rendered much stronger by defensive works. It was the most nearly a "pitched" battle of any fought by Marlborough, and was proportionately bloody. In the mist of the early autumnal morning the allied artillery was placed in position, "forty pieces were massed in a single battery on the open ground against the French left, and were covered with an epaulment for defence against enfilading fire; twenty-eight more were stationed against the French right, and the lighter pieces were distributed as usual among the different brigades".[1] From the time the fog lifted at about 7.30 a.m. until the great battery gave the signal for attack about nine o'clock, the woods between and within which the fighting was to take place, echoed and re-echoed to the sound of the opposing artilleries. In position and protection the French guns had the advantage. With the fighting in general we cannot deal. But it is worth remarking how at the moment when the Allied effort to turn the French left in the fastnesses of the woods was beginning to affect the steadiness of the whole French line to such a degree that Marlborough judged the time ripe for the decisive blow against their centre, he moved his main forty gun battery forward to help the attack on the entrenchments, dividing it into two parts which from right and left poured in their fire on the French as they reinforced and successively though vainly attempted to stem the advance of the allied infantry. The success of this movement marked the French defeat in which therefore the artillery can justly claim a share, bought though it was at a loss which made the battle, before the last war, "one of the bloodiest ever fought by mortal men".

Though the word 'Ubique' is of later date, these years immediately preceding the foundation of the Regiment saw gunners in companies or smaller detachments making a claim for the later use of the word, though we have hardly space even to mention their efforts. There were British gunners fighting in the army of Peter the Great in his struggle with Sweden, being imprisoned after the battle of Narva in 1700. There was a company in Scotland which after the Union was reorganised as the "Train for North Britain", primarily responsible for the defence of Edinburgh, Stirling and Fort William. Chief after the Flander's trains during the war were those sent to the Peninsula, there winning and losing battles and guns, besieging and being besieged far beyond a sentence or two of description. The original company of fifty sent out in 1703 was added to until in 1707 the artillery in Spain was organised into two companies of one hundred men each, with the future first Colonel of the Regiment, Albert Borgard, as Lieutenant Colonel, part of it accompanying him in the expedition which captured Minorca. The necessity for providing permanent garrisons for the newly captured

[1] Fortescue, *op. cit.* i, 521.

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Gibraltar and Port Mahon brings us to a new era in the history of the garrison gunner in that we now first find him doing garrison work abroad on a permanent basis. Nor do we only find him in the Mediterranean. There had been fighting, conquest and the promise of further conflict in North America and the West Indies as well as in India. A train of artillery was sent to the West Indies in 1693, and Bermuda also had a small garrison. The definite cession of Newfoundland to Britain in 1713 implied a garrison of twenty gunners for Placentia. Three years earlier Annapolis (Port Royal) had finally passed into British hands and received a garrison of sixty gunners, etc. Thus the gunner is becoming both ubiquitous as well as permanent, a process which led, not before it was time, to the establishment of an artillery Regiment.

(To be continued).

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SOME EPISODES DURING BATTLE-FIGHTING ON THE WESTERN FRONT.

Continued from the July number of "The Journal."

Communicated by

MAJOR-GENL. SIR H. C. C. UNIACKE, K.C.M.G., C.B.

Corrigenda to Episode XIX. Page 189, line 7. For "*Divisional Headquarters*" read "*Divisional Artillery Headquarters*".

XX. An incident during the fighting for the Paschendaele Ridge.

ON the 19th August, 1917, "D" Battery, 280th Brigade, R.F.A., commanded by Major E. R. C. Warrens, D.S.O., R.F.A., was in action north of Zonnebeke, near Halfway House. During the morning the enemy put down a terrific bombardment on this and neighbouring batteries. There was little or no shelter and very soon the ammunition was set on fire throughout the whole battery position. The Battery Commander accordingly, in order to save unnecessary casualties, ordered the position to be cleared. On a muster being made it was found that two men were missing. By this time the gun-position was an inferno, our own ammunition dumps and enemy shells detonating in it continously—the German guns having seen the blazing cordite and in consequence redoubled their rate of fire in order to complete the wreck of the battery.

Sergeants H. W. Linney, W. Inskipp, and Corporal S. Ford notwithstanding this at once volunteered to return and search the position for the men reported missing. This they did at the imminent risk of their lives and found one man still alive but badly wounded, whom they brought away. They were hardly clear when a terrific explosion occurred over the whole battery position.

Subsequent inspection after the bombardment had died away showed that of the six guns nothing was left but scrap-metal; and that two had utterly disappeared.

XXI. In the Ypres Salent.

"C" Battery, 162nd Brigade, R.F.A., was in action south of Zillebeke from the 13th September to the 22nd October 1917 during the fighting for the Passchendaele Ridge. Between these dates

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the battery was under unceasing heavy shell fire having no less than 19 guns destroyed or put out of action by direct hits. The battery at all times displayed great gallantry, never failing to respond to calls for their fire whatever the conditions. On one occasion after it had become necessary to clear the battery position temporarily owing to intense concentrated fire of German 8-inch batteries right on to it—two guns being completely destroyed—the "S.O.S." was received from the infantry. Led by their officers the men manned the remaining guns and fired till the order "Stop" was received—the hostile shelling increasing in violence as time went on. One officer and ten other ranks were killed and several wounded on this occasion.

Again on the 4th October in precisely similar circumstances the detachments manned the guns instantly on the "S.O.S." being given—after the position had had to be cleared. While firing in response to the call one gun was destroyed and 12 other ranks killed and wounded by shell fire.

Between September 13th and October 17th 1917, 4 officers and 16 other ranks were killed and 2 officers and 80 other ranks wounded in the battery. It was not until at last they had insufficient men to maintain the guns in action that the battery reported it could not carry on as efficiently as was to be desired. Orders were in consequence given that the battery was to be withdrawn from action and it accordingly returned to its wagon-lines—four N.C.O's and six gunners being all that was left.

XXII. An episode of rearguard fighting.

On the 4th April 1918, "B" and "C" Batteries of the 107th Brigade, R.F.A., could only muster five guns between them—the rest having been put out of action during the continuous rear-guard fighting since March 21st. The Batteries were in action in a hastily dug position six hundred yards west of the Bois de Senecat, west of Castel. At 5.30 a.m. the German Artillery started a heavy bombardment right on to both batteries. Major J. R. Grieve, M.C., R.F.A., Commansding C/107 Battery was killed almost immediately and two of the guns completely knocked out, their detachments becoming casualties to a man. This left only three guns between the two batteries.

Captain B. G. Twycross, M.C., R.F.A., Commanding B/107, the senior surviving officer took command of both batteries, reorganised what men were left into fresh detachments and kept all the guns in action.

The line in this sector was held by dismounted French cavalry. These gave way and retired in some disorder on the battery position. Captain Twycross rallied them and ordered them to occupy a line some little way behind the guns. As soon as this line was established two guns were sent away to a position in rear of it, while the remaining gun, with its team and limber standing just in rear—in complete isolation—continued to fire steadily over open sights at the enemy's infantry attempting to deploy from the Bois de Senecat—until the last round of ammunition in the battery position had been expended.

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The gun was then limbered up and withdrawn, quietly and in order, to the next position, under heavy fire from machine guns which the enemy rushed forward as soon as it became evident that the gun which had hitherto held them completely in check, had ceased firing.

XXIII. A minor incident.

On the 30th November 1917, when the Germans succeeded in capturing Gouzeaucourt the spare stores of the 108th Siege Battery, R.G.A. (6-inch Howitzers) were in a cellar in the outskirts of that village. The only occupants of the cellar were a dour old Scotch gunner acting as storeman and a battery cook.

Hearing a good deal of commotion these two came up to see what was going on, bringing with them their rifles and a box of ammunition. They found the village in possession of the enemy. A German officer with 6 privates at once came up and called on them to surrender. With a most uncomplimentary reply the two gunners shot the officer and also one of the men who had started to run away, and disarmed and took the remaining five prisoners, rounding them up and driving them down the cellar. They kept them there until Gouzeaucourt was retaken by the Guards, when they handed the prisoners over, apologising that they had not been able to get more while they were about it.

XXIV. Action of a single gun in close support of infantry.

On November 1st, 1918, Lieutenant Gorle, R.F.A., "A" Battery, 50th Brigade, R.F.A., was in charge of a forward gun of the battery with orders to act in close support of the attack of the 11th Battalion of the Royal Scots. He brought his gun into action in line with the leading infantry four times during the morning against enemy machine gunners at close range who were holding up the advance, and knocked them out.

In the afternoon the infantry had become exhausted owing to the hard fighting they had undergone and the intense hostile fire, and began falling back behind the line of the railway. Lieutenant Gorle seeing the situation at once, without the slightest hesitation, took forward his gun into action right out in front of the leading line of infantry in face of very heavy machine-gun fire and a close shooting German gun and remained there, isolated, engaging the enemy's posts. His gallant action and the sight of the solitary gun fighting stoutly quite unsupported checked the withdrawal of our infantry and encouraged them, weary as they were, to advance anew to the attack—thus saving the loss of the village to the enemy.

The coolness and steadiness of this subaltern and his detachment under the heaviest machine-gun fire and that of a German gun was beyond praise. The gun was served and layed so accurately that the enemy's posts were all knocked out in turn, and the gun limbered up and withdrawn as if on parade.

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XXV. Action of some of the batteries of the 18th Divisional Artillery on the 21st March, 1918.

"A" Battery, 82nd Brigade, R.F.A.

On the 21st March 1918, "A" Battery, 82nd Brigade, R.F.A., commanded by Captain W. Dennes, M.C., R.F.A., was in action about 1000 yards west of Fort Vendeuil. About 12 noon German infantry appeared in large numbers in front of the wire of the Ly Fontaine—Vendeuil switch line, which was some 300 yards from the guns.

From this time onwards the battery engaged the enemy infantry at the closest range, inflicting very heavy casualties on them and driving them back time after time.

About 3.45 p.m. Captain Dennes sent a message by runner asking for assistance, saying that he was holding his own but the enemy had worked up close, were sniping the gunners on the guns, and that he was losing a good many men. Shortly afterwards Capt. Dennes was hit by a sniper and believed to be killed. 2nd Lieut. R. G. M. Jones, R.F.A., took command and sent a runner back to the nearest infantry post with a message to say that he intended to remain where he was and hold out to the last, and asking for the support of rifle fire on his flanks. The runner, however, lost his way—the message was not delivered in time and about 5 p.m. the battery position was rushed by the enemy and the few survivors in it were captured.

"B" Battery, 82nd Brigade, R.F.A.

A forward section of this battery was in action 500 yards south of A/82nd Brigade's position. It was commanded by 2nd Lieutenant A. E. Bishop, R.F.A., who was most ably assisted by 2nd Lieutenant J. H. Lightbody, R.F.A. This section remained in action all day although the enemy had got round both flanks.

At 1.30 p.m. they were able to engage the German infantry south of Fort Venduil over the open sights and by 6 p.m. had fired over 800 rounds into the enemy at very short range. When it was seen that A/82 had been captured the section turned on to the enemy now in possession of the position and drove them away from the captured guns. As the situation, the enemy now being round both flanks, did not admit of the slightest hope of being able to save them, the guns of the section were destroyed at dusk and the detachments successfully withdrawn.

The officer commanding the battery, Captain A. A. Prentice, R.F.A. after visiting the section at 2 p.m. and seeing the situation for himself returned at once to his Battle Zone O.P. and directed an effective fire from the remainder of his guns and those of other batteries of the Brigade on to hostile infantry moving over the crest south of Vendhuil, holding them up and delaying their advance so effectually as to enable various isolated posts to withdraw at dusk.

"C" Battery, 83rd Brigade, R.F.A.

This battery, commanded by Capt. L. McG. Haybittel, R.F.A., was in action in three dispersed section positions south-east and south

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of Benay—the Battery Commander being in charge of the most forward one.

This latter section was rushed by the enemy from the east under cover of the mist at about 11.15 a.m. Captain Haybittel however managed to remove the breech blocks and withdrew his detachments, fighting with their rifles, to the next section position. Before either of these two guns could be fired the German infantry were found to be right upon this position also, advancing down on them from the north. Breech blocks were again removed and the combined gun detachments withdrawn to a sunken road where a defence was organized with the battery rifles and a machine gun which had been picked up—the further advance of the enemy's infantry being completely held up. After an hour of this, telephone communication was firmly established with the rear section and its fire directed with very great effect, several machine guns which were causing much trouble to the party in the sunken road being knocked out and heavy casualties inflicted on the enemy.

This position was held until 8 p.m. entirely by the battery personnel and the fire of the last remaining section, and repeated attempts of the enemy to rush it werse beaten off with loss. It was continuously under machine gun fire, rifle fire and was shelled by one of our captured guns. The two guns of the section fired 1900 rounds during the day.

At 8 p.m. only one gun was fit for action and that was jamming badly, Captain Haybittel accordingly re-organised his rifles under 2nd Lieutenant M. N. S. Jackson, R.F.A., and 2nd Lieutenant H. J. Raban, R.F.A., to cover his withdrawal which had now become imperative owing to the renewed pressure of the enemy's infantry and his isolated and entirely unsupported position. The withdrawal was successfully carried out about 9 a.m. the covering party succeeding, during the progress of the withdrawal in capturing an enemy machine gun and taking prisoners a detachment of German infantry who had worked round in rear of the gun position with a view to rushing it under cover of darkness.

"D" Battery, 83rd Brigade, R.F.A.

This battery, commanded by Major A. D. McPherson, M.C., R.F.A., had two sections forward in action east of Ly Fontaine, and one section north of Ly Fontaine close to Brigade Headquarters. This latter section suffered very heavily from the hostile preliminary bombardment—the whole of the gun detachments being wiped out.

2nd Lieutenant L. F. Ellis, R.F.A., was sent back from the forward position to reorganise this rear position with fresh detachments sent up from the wagon line. Meanwhile the personnel of 83rd Brigade Headquarters were lined up in a trench by Lieut.-Colonel T. O. Seagram, D.S.O., R.F.A., armed with rifles in order to protect the two howitzers.

By 12 noon the section was again engaging the enemy at 500 yards range and finally at 200 yards—the gunners as they fired having to crouch down to avoid splinters flying back from their own shells.

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A German battery which attempted to come into action against them at 1,500 yards was at once engaged, the teams stampeded, and the guns so knocked about that they never opened fire all day.

This section remained in action under close range machine gun fire until 6 p.m. when their last remaining round was fired.

The gun detachments remained with their howitzers until 11 p.m. in the hope of getting more ammunition, or at least of being able to withdraw the howitzers, but the enemy's infantry by this time had worked right round both flanks of the position and the limbers, much against their will, were not allowed to go up. The howitzers were accordingly disabled, and the detachments fought their way back to the nearest infantry posts.

18th Divisional Ammunition Column.

On the 23rd March 1918, the wagons of No. 2 Section under 2nd Lieutenant E. Adkin, R.F.A., went up to supply the batteries in action about Faillouel with ammunition. The German infantry having advanced very rapidly unobserved through woods it became urgently necessary to withdraw "Z" Battery, R.H.A. and the 402nd (Howitzer) Battery of the 5th Army Artillery Brigade to prevent their being cut off. The wagons of No. 2 Section being close at hand they were called up to do this and brought out the batteries under very heavy hostile fire—afterwards returning and delivering their ammunition in accordance with instructions.

XXVI. Moving Warfare.

On the 25th August 1918, the 280th Brigade, R.F.A., occupied positions S.W. of Boisleux-St.-Marc. At 5 p.m. orders were received to advance the Brigade to support an attack on the trenches between Boiry Becquerelle and Croissilles at 7.30 that evening. The wagon lines were some distance away from the guns and the utmost dispatch was necessary.

All Battery Commanders immediately went forward, selected their positions, worked out their barrages in shell holes, and got their guns into action in time.

"C" Battery of the Brigade commanded by Major A. V. Reid, M.C., R.F.A., had a small problem to tackle on the way up. The ground sloped gently up to Summit Trench which was our infantry front line. Behind a small intervening rise most of the Divisional Artillery had found positions and the area was rather crowded—this determined Major Reid to advance further under the main crest to a position some 600 yards behind the front line. As the battery moved up, the intervening crest was very heavily bombarded by the enemy with gas shell. The Battery Leader, Lieutenant E. L. Wood, M.C., R.F.A., was placed momentarily on the horns of a dilemna—to stop, adjust gas masks and make a detour so as to avoid the worst of the gas cloud would mean being late for the opening of the supporting barrage. He made up his mind to make a dash for it. Giving the signal to gallop he rushed his battery through the gas cloud and brought the guns into action just in time to commence the barrage programme as arranged.

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His casualties were negligible. The battery had answered the call made on it showing that even after nearly three years of the petrifying influence of trench warfare a well trained battery could rise to the occasion when it was necessary to get a move on.

XXVII. An incident during the preliminary bombardment for the third battle of Ypres.

On July 16th, 1917, the task of cutting wire along the hostile front line from Wee Cottage to Hooge Crater was allotted to the 55th (Howitzer) Battery, R.F.A. The battery was in position on the northern edge of Zillebeke Lake and had already been several times engaged by enemy heavy howitzers from the direction of Polderhook.

It was estimated that 400 rounds would be required to clear away the wire effectually and deliberate fire was opened. After some 50 rounds had been fired a German 15$^{c}/^{m}$ Howitzer battery firing in direct enfilade opened a steady and extremely accurate fire on the battery position.

Each time the battery opened fire, salvo after salvo of 15$^{c}/^{m}$ shell burst right on it. Two ammunition dumps were exploded almost at once. Gradually one by one the guns were put out of action by direct hits which shattered them and their detachments, until at last only two out of the six were left. These two kept up their fire until the full tale of 400 rounds was expended.

When our subsequent successful advance took place the wire was found to have been completely cut.

(To be continued.)

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New Books and events reviewed including "Electrification of Railways" which is interesting.

The writer points out that the electrification of the Belgian Railways was thought out most thoroughly from every point of view except the military one. He draws attention to the German "Militär—Wochenblatt" 21 April, 1920, and points out how the German scheme started in 1907 for electrification of main lines, dealt with the vulnerability of Power-Stations, means of conducting electricity, etc. This was to be met by having oil engines as well as electrically driven locomotives so that in case power stations, etc., were destroyed in war, railway transport would not be interrupted in Germany and war could be carried into an enemy country whose railway system was not electrified.

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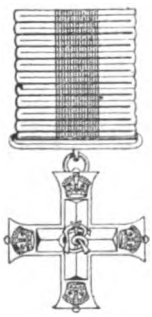

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"DUNCAN" COMMENDED ESSAY, 1919-20.

"The Reorganisation of the Royal Regiment of Artillery with a view to obtaining in war the best value from modern equipments with a minimum of expenditure of human energy."

By Capt. A. L. Pemberton, M.C., R.G.A.

"HUMATA, HUKHTA, HVARSHTA."

"Alone among the nations Britain has abolished conscription. That was a tremendous decision, but it was the undoubted wish of the nation. The Military Authorities had loyally accepted the decision, and they were doing their best to make a success of the voluntary system."

SO said the Secretary of State for War and Air in the House of Commons on February 23rd of this year, and so must we prepare to cut our suit accordingly. On March 31st, 1920, conscription will have ceased in the United Kingdom, and we shall again be dependent upon a small, highly trained, volunteer army for the immediate defence of our Vast Empire and, for the present at any rate, of an almost equally vast expanse of mandatory territories. But though the lesson of the past four years of incessant bloodshed and suffering has failed to prevent us from relapsing once more into our pre-war state of military impotence, there is yet much for which the Royal Regiment itself has to be thankful. From the end of 1914 onwards it attracted to its ranks large numbers of skilled brainworkers from all over the Empire, mathematicians, scientists, engineers and the like, each of whom had something of value to teach us. Many of their suggestions we have gratefully, and rightly, adopted but the greatest lesson of all, we think, has still to receive the just appreciation it deserves. It was their mental attitude, the clearness of conception engendered by their training as business men, that was the real secret of their success in assimilating themselves so easily and quickly to their new surroundings, and has helped to bring fresh and invigorating ideas into the study of Artillery problems in the field. Now that they have departed once more into the busy world from which they came we shall be wise to remember the lessons they have taught us and apply them to the period of re-organisation that lies ahead of us. The very title of this essay seems to us to exhibit a commercial flavour that is not to be ignored. It is, therefore, with a proud assumption of the Napoleonic title, that, as one of a "nation of shopkeepers", we propose to treat the re-organisation of our Regiment as a definite business proposition.

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Viewed from this standpoint the subject resolves itself naturally as follows:—

(1) Supply and Demand.
(2) Liabilities.
(3) Assets.
(4) Organisation.

We will now proceed to discuss these four important questions in their proper order.

Supply and Demand. Without going too deeply into the question of economics which is outside the province of a purely military essay, it is nevertheless important that we should grasp the full meaning of these two words in order that we may come to an exact understanding of the great difficulties that confront the employer—i.e. the War Office—in our particular case.

It is the employer, or consumer, who demands and the employee, or producer, who supplies, but it must be remembered that every producer is eventually himself a consumer. The quantity and quality of the demand is regulated by the employer's liabilities—military policy in this case—and the quantity and quality of the supply partly by man's necessities as a consumer and partly by his instinct for self aggrandizement. Thus, for example, it is man's necessity that drives him to work for a living but it is his instinct for self aggrandizement that prompts him to bargain for the best wages possible.

Now we think that it will scarcely be denied that the quality of labour required by the Army in general, and the Royal Artillery in particular, has greatly increased during the war and is likely to go on increasing in the future. Without any intention of belittling the magnificent services performed by our little body of "hired assassins" in 1914, there is no doubt that we cannot in future be satisfied with the material that we have accepted in the past. We must endeavour to draw the very best of the nation's manhood into the ranks of the New Army, and to do this we must be prepared to compete with the other employers of the particular kind of labour we desire. We must therefore ask ourselves what are the chief inducements held out by other employers of labour on a large scale and compare them with what the Army has to offer.

Stated briefly they are as follows:—

(1) High wages.
(2) Pensions.
(3) Assured employment.
(4) Good conditions of service.
(5) Good openings.

Unfortunately it is just in the most important subject of wages that the Military Employer suffers from a very serious disadvantage, since he relies for his income—in the shape of Army Estimates—upon the very business rivals against whom he is contending for his supply of labour. It stands to common sense, therefore, that no matter how much the pay of the Army has been increased recently, or may be further increased in the future, it will never be allowed to menace the prospects of those great civilian employers of labour,

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who contribute so largely towards its upkeep. Undoubtedly from the point of view of wealth production the Army is a bad business and it may truthfully be said that nothing but a wholesome feeling of fear and instinct for self-preservation, decently garbed by the politician in the vague and often shadowy robe of patriotism, stands between us and total extinction. It is only in moments of direst peril that this euphemistically termed patriotism will be strong enough to overcome that spirit of self-aggrandizment already referred to. Finally it must not be forgotten that the Military Employee is not at liberty, as are other Government employees, to indulge his resentment at real or supposed injustices by the simple method of going on strike.

This question of wages is of course a permanent one, but besides it there are two other factors, more temporary but none the less vital, which we must not fail to take into consideration. They are (1) the general spirit of war weariness that has overcome most of the peoples of Europe and cannot but have a deleterious effect upon recruiting in this country for several years to come, and (2) the world wide evil of Bolshevism, which is at least a serious menace to the peace and security of the British Empire.

We must, therefore, do all in our power in the future to make up for these initial disadvantages by offering greatly increased inducements in other directions and, above all, building our house upon a sure foundation. In pre-war days the chief inducements that we were able to hold out were pensions, assured employment and the vulgar but by no means negligible enticement of a brilliant uniform. To-day it seems more than likely that we shall lose at least a part of the latter attraction, and all that there is left for us to turn to is the matter of good openings. In this direction it is reassuring to note that a movement is already on foot to provide for the better education of all ranks and to enable them to make use of their leisure hours by fitting themselves for some civilian occupation to which they can turn for a living when their "Colour" service has been completed. This is a good thing no doubt but it is not enough. We must do more than merely equip our soldiers with the technical knowledge necessary to enable them to sieze opportunities in the business world. We must endeavour to create openings for them.

Otherwise, however skilled they may be, they are likely to find themselves shut out of work by the action of the Trades Unions as has been happening only too frequently of late.

As a start we might certainly do much to improve the nature of the openings within the Regiment itself. During the latter part of the war we believe nearly 90% of the regular commissions granted came from the ranks and no one will suggest that the results were unsatisfactory. We ought to see to it then that a fair percentage of commissions are reserved each year for selected members of the rank and file. Another matter that most certainly requires attention is the resuscitation and revision of our old Gunnery Staff Courses, etc., especially with the object of training individuals for the work of B.M's R.A., Staff Captains and Reconnaissance Officers.

To sum up, if our Artillery is to lead the world, not only in material and equipment but in method and application—as it did in 1818

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and again in 1919—we must above all things keep up-to-date and to do this we must run the show on business lines as far as possible. In the past our supremacy, in material at least, has too often appeared only in the closing stages of the campaign and then as soon faded for lack of the necessary incentive to its existence. The only thing that can take the place of the urgent competition induced by war is a healthy trade rivalry in times of peace. As another writer has pointed out in the R.A. Journal " Why should not our present superiority in gunnery and gun construction establish the pre-eminence of our gun foundries and develop their foreign trade? The advantage our potential enemies may gain by the possession of British made guns will be counterbalanced in time of war by our increased power of output. This renumerative aspect of the artillery is worth great attention." It is indeed worth the greatest attention.

Liabilities. In discussing the subject of our liabilities we must first of all turn to our official manuals for a definition of the true rôle of Artillery in modern warfare. F.A.T. 1914 tells us that our primary objects, which are twofold, may be attained by (a) inflicting losses on the enemy and breaking down his fighting spirit (b) destroying his material (c) reducing the resisting power of fortified localities and rendering them easy of approach. To this Artillery Notes No. 4 (S.S. 139/4) dated February, 1917 adds the information that "Artillery has so developed both in power and quantity during the past two years that it has become a much stronger weapon of offence than heretofore." To make a generalization of it our rôle has been briefly summed up by many expert authorities in the three words Kill the Enemy.

On the whole we may take it that the guiding principles upon which our great business has been built up remain as true to-day as they ever were, and in seeking for new liabilities it is rather to the sphere of politics that we should turn our attention. Home politics have already been sufficiently discussed in the introduction to this essay so we may proceed at once to Foreign Politics. Here we find the League of Nations still nothing more than a pretty piece of idealism, and the war that was to end all wars achieving nothing but the transformation of war into a kind of scientific murder. The Secretary of State for War and Air, in the speech from which we have already quoted, tells us plainly that "a day might come when our reserve of war-trained manhood would have grown old, and when our accumulation of war stores would be used up or would have become obsolete, and if that period coincided with the revival of the military strength of Germany, or of the military strength of Germany and Russia combined, the arrangement which he had described (i.e. our Post Bellum War Establishments) would require drastic and timely revision."

But this, at least, is a skeleton that lies buried at the present at the bottom of a very deep cupboard, and that cupboard is the general state of physical and financial exhaustion that holds most of Europe in its grip. More pressing concerns at the moment are the troubles we have been experiencing in our Indian and Egyptian dependencies, the Syrian and Armenian questions and the time-honoured tangle in the Balkans. These are problems that call for

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quick decisions and the moral courage to see them through and indicate an immediate return to the cult of open warfare as the foundation stone of military thought and training. But we must not rest content with the re-introduction of our old systems of teaching, excellent as they were in their way. There are three great objectives before us in the future. (1) Mobility and Elasticity of Mind. (2) Individual Initiative. (3) Mutual Sympathy and Co-operation between all ranks and all classes. The Germans failed in the Great War through lack of (1), the Russians through lack of (3), and we look perilously like failing in the future through a lack of (2).

Assets. Under this heading it is proposed to discuss all weapons of destruction, other than the rifle, that have in the past, or may in the future, form part of the armament of the Royal Artillery. For this purpose the subject may conveniently be divided into the following sub-headings. (a) R.H.A. (b) R.F.A. (c) R.G.A. Mountain. (d) R.G.A. Heavy and Siege. (e) R.G.A Coast Defence. (f) A.A.C. (g) Trench Mortars. (h) Tanks. (i) Infantry Guns. (k) Lewis Guns. We will consider each of these subjects briefly in their turn, noting more particularly what are the teachings of our official manuals in each case and to what extent they have been modified by the experiences of the recent war.

(a) R.H.A. F.A.T. 1914 says "Occasions for the employment of shock tactics against Infantry and Artillery may arise on the battlefield of the future, as they have in the past." It is also of interest to note that before the war England, France and Russia alone of the Great Powers had adopted a special form of horse artillery in their field armies. In France and Russia they were of the same calibre and fired the same ammunition as the ordinary field guns—15·96 and 14·45 lbs. respectively—whereas in this country the horse artillery gun was entirely different from the field gun.

Now what are the lessons of the war? The part played by the R.H.A. during the earliest days, and more particular during the retreat from Mons, has already become an epic in the history of the Regiment. As the fighting began to settle down into a more or less permanent condition of stale mate, or trench warfare, on the Western front they naturally found themselves somewhat out of their element. In Palestine and Mesopotamia, on the other hand, where open warfare remained the order of the day until the bitter end they continued to live up to the expectations of the military prophets. Nor, even in France, did they entirely succumb to the blighting influences of trench warfare. Lieut.-Col. W. H. F. Weber, D.S.O., R.F.A., writing of the period November 1917, has told us that "in some R.H.A. units open warfare was constantly practised; and at our schools, where voices from Mesopotamia and Egypt were heard, a just appreciation of open warfare was taught." Again Major General H. C. C. Uniacke, C.B., C.M.G., writing of the actions performed by the Artillery of the Fifth Army in March and April 1918, says "The 3rd Brigade R.H.A., in support of the 2nd Cavalry Division on April 1st, by making full use of their mobility combined with a bold policy, accounted for a very large number of the enemy and very materially assisted in the success of the operation."

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The conditions of trench warfare do not therefore seem to have permanently killed the utility of the horse artillery weapon and the huge open areas that lie within the boundaries of the British Empire render its existence just as important now as it was in the days of its reputed founder, Gustavus Adolphus, nearly three hundred years ago. In spite of new whippet tanks that can move at a speed of twenty miles per hour across country over fences, hedges, and ditches the horse is still a vital factor in war, in proof of which we have only to notice the furore caused amongst military experts recently by the suggested abilition of the Yeomanry.

(b) R.F.A. The chief point to notice here is the general tendency of the field gun and howitzer to become more and more closely allied to each other as regards the principles of their employment. Thus in S.S.139/4 (Artillery in Offensive Operations) dated February 1917, we read that "the field howitzer in future will have nothing but instantaneous fuzes and so be chiefly a man-killing weapon." So great has been the moral effect of the extraordinarily successful results given by the 106 fuze that some short sighted enthusiasts have already begun to herald the advent of the howitzer as the sole weapon of the field artillery. For ourselves, we do not see how these reformers would overcome the difficulties of the rearward effect of such powerful H.E. in the case of the "creeping" barrage or in close defence work. Nevertheless it is a distinct indication of what we may expect in the future, and we are prepared to believe in the possibilities of the hybrid gun-howitzer, if such a weapon can be perfected to meet all requirements.

(c) R.G.A. Mountain. During the recent war in France, owing chiefly to the unfortunate position of this arm, which was produced by the British Government, employed by the Indian Government, and cared for by neither, it quickly got left behind in the race for modernity and people at home were inclined to forget the terms of F.A.T. 1914, Section 144. There we read that "batteries of mountain artillery are peculiarly suited to work with infantry in difficult country of any kind" and also "in the defence of woods, in temporary forward positions occupied by the defence, and in rearguard action, its mobility and easy concealment will often enable it to render valuable service."

In Gallipoli, in Mesopotamia, in East Africa, and in Palestine our mountain gunners have striven valiantly, and on the N.W. Frontier of India are still striving to fulfill these obligations in spite of the antiquated weapons they are armed with. Meanwhile the Secretary of State for War and Air has told us that we are to return to a voluntary army on the pre-war basis, whose first duty will be to act as a police force throughout the Empire. To rob such a force of an efficient and up-to-date mountain gun (and howitzer) equipment would be equivalent to robbing the London "Bobby" of his truncheon.

In this particular department Russia was by far the most advanced of the Great Powers before the war. She had an excellent little 'pack' horse artillery weapon with limbers and riding saddles capable of rapid transformation into pack loads. The adoption of such a weapon in our own army is undoubtedly worth our serious attention.

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(d) Heavy and Siege. The lessons of the South African and Russo-Japanese Wars plainly indicated, the Germans always believed, and the recent war fully proved that Heavy Field Artillery —at least to include 60-pdrs. and 6-in. hows.—must form part of every Field Army in the future.

Major General Uniacke tells us that in the Fifth Army, during the Hun break through in March 1918, Heavy and Siege units "adapted themselves to the requirements of open warfare mobility and direct laying with a facility equal to that of the Field Artillery" and again "cases are on record of the Infantry retiring behind 9·2″ Batteries which continued in action long afterwards until dismantled and withdrawn under cover of their own Lewis Guns."

Lieut.-Col. Weber also, writing of November 1917, says "Our 18-pdrs. were hopelessly outranged. Strengths were mostly much below establishment. Under such conditions the Heavy Artillery, a growing giant, had assumed the artillery offensive work, while the Field Artillery performed merely protective duties in attack and defence."

That puts the case clearly enough for the Heavy and Siege units of our Regular Post Bellum Army. There are, however, at present three great disadvantages under which these two branches labour, partly as the result of their extremely rapid development during the stress of a great war. The first, and greatest, of these lies in their very nomenclature itself. The two words Heavy and Siege imply a dual nature and a dual organization that is not compatible with efficiency in action or economy of force and labour. One might just as sensibly take away the 4·5 How. from the Field Artillery Brigade and group it with the Siege Artillery.

The second great disadvantage is the existence of two entirely distinct natures of transport, the horse and the motor, which, with young and inexperienced soldiers, often made interchanges of personnel within the Brigade absolutely impossible. This, of course, would not apply so much to a well trained army, but there is no doubt that much of the present trouble is unnecessary and ought to be eliminated.

Finally there is the extra-regimental organisation of the Mechanical Transport of Siege Batteries. This is a difficulty that is not new to history, having occurred before in the old Driver Corps of the first half of the nineteenth century and the hire system that preceded it. Now that we have breathing space in which to glance round and set our house in order it is only natural to presume that the mechanical transport and its drivers will become an integral part of the battery, and that a special study will be made of the question of road speeds of the various natures of tractors and lorries to enable the battery to remain a properly equipped fighting unit throughout all stages of the approach march and the subsequent attack or retirement.

We should expect, then, in the near future to see horse drawn 60-pdr. and 6-in. How. batteries—and possibly mechanically drawn 9·2 gun—how. batteries—become part of the normal Divisional Artillery as Heavy Field Artillery, whilst the 9·2 How., 12-in. gun and how., and 15in. hows. will form the Siege Train for use -in the

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attack of fortresses, or after the fighting has definitely settled down into the conditions of trench warfare.

(e) Coast Defence. Probably no branch of the Regiment has undergone such radical changes of ideas during the war as our Coast Defence Units, in which movable armament is now recognised as a most valuable asset of the defence, and the general principle of distribution by depth is admitted to be as important here as elsewhere. The final fate of our Fixed Armaments must yet be uncertain, but whether they are done away with altogether, or are handed over to the Navy, or definitely incorporated into the various Fire Commands the fundamental fact remains the same, namely that the Coast Defence gunner can no longer live in splendid isolation, as he has sometimes done in the past. He can no longer be content with wearing the word Ubique on his cap; he must have it written in indelible letters in his brain.

(f) A.A.C. This is likely to be of ever increasing importance in the future, and the very special type of brain and expert technical knowledge required for its efficient use, gives it a very distinct position of its own. Whether fixed or mobile guns will be found best for defending home stations remains yet to be seen, but mobile batteries are certain to be required to accompany the Field Army.

(g) Trench Mortars. Have been defined as the economical heavy artillery. Though apparently of little use for protective barrages in the defence they are exceedingly useful in the attack, and, when properly provided with pack transport—as was the case with our troops operating in Italy—may be of great value in pushing home an advantage gained in the early stages of the attack before the main artillery has had time to come up. For this reason they should be closely allied to Mountain Artillery.

(h) Tanks. Tanks, like A.A.C. guns, require a very special technical knowledge and therefore form a distinct class of their own. At the same time there is little doubt that, as recognised death dealing instruments, they should form part of the Artillery of an Army if their adoption is finally decided upon. This, however, remains in doubt for the present since the Secretary of State for War and Air has told us of a new form of rifle grenade that is capable of inflicting mortal injury upon the tank. If successful at its trials such a weapon incidentally removes another possible offspring of the Regiment in the shape of the Anti-Tank gun.

(i) Infantry Guns. These are said to be exercising the ingenuity of the French and German Artillery inventors, but the writer is inclined to think that all that is required of them can be satisfactorily performed by our Mountain Artillery if properly equipped and trained.

(k) Lewis Guns. There is little doubt that the Lewis Gun has come to stay, and the excellent service it has rendered in the close defence of battery positions on the occasions of an enemy 'break through' combined with its value as an anti-aircraft weapon make it a most welcome addition to the equipment of a battery.

This concludes a somewhat formidable list of assets but before passing on to the next section a word of justification and explanation is due. The reader has perhaps begun to question the sanity and

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seriousness of a writer who, in dealing with the subject of artillery work in the Great War and its possible developments in the future, has not once mentioned the word aeroplane. Let us hasten to explain that the omission is not unintentional but that, on the contrary, we feel such a lively appreciation of the value of aerial co-operation that we have set apart this particular paragraph for its sole discussion. The immense possibilities presented by the gradual perfection of wireless telephony, and the simplified production of radio-activity alone seem to bring the aerial charger within reach of every battery commander in the near future and if it is true that the Americans have carried out successful experiments with an aeroplane equipped with horizontal propellers instead of planes and thus capable of hovering over a target and rising from or settling upon a roof top like a bird, the powers of observation from the air will be greatly facilitated.

To return, however, from fancy to fact the situation is that for the present we are to have, in addition to the Independant Air Force, small naval and military wings for special reconnaissance and observation work in connection with these two services. The exact means that is to be adopted to ensure the very close co-operation and mutual sympathy that will be necessary between the ground units and their aerial auxiliaries has not yet been revealed to us, so we must content ourselves with a statement of our own opinion of the case. Perhaps one of the most outstanding features of the recent war—and especially during trench warfare conditions—was the extraordinary amount of useful and often valuable information that came direct to Divisional, or even Brigade, Commanders from Artillery O.P's, patrols, and Command posts. This, of course, is only as it should be since the very essence of artillery work is timely information and a swift decision as to how to act, based upon a correct knowledge of the employment of all the other arms.

It is, therefore, only reasonable to assume that gunners will take a gradually increasing part in the aerial reconnaissances of the future until the day at last comes when the battery commander, discontented with the view from his O.P., flaps his wings and flies off to some better point of vantage. In the meantime we should see that the officers and men of the Royal Artillery and the airmen who are to work with them, get to know each other far more intimately than they have ever done before. This can only be achieved by living close beside each other in the same barracks with a common Mess in which friendly exchanges of opinion may take place from day to day to the infinite good of all concerned and to the exclusion, we may hope, of that tendency towards narrow-mindedness and bigotry that was so often to be found in our pre-war messes. Nor must this spirit of camaraderie be confined to the Heavy Field Artillery. If the Light Field Artillery are to maintain that power of offensive action that is indispensable to every branch of our Regiment, they must also look to the air for their future greatness.

We come at last to the most important subject, that of Organization. In introducing this subject we cannot forbear to dwell for a moment upon the question of the Directorate, which has already given rise to so much, and often heated, controversy. In accordance

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with the spirit of this essay we propose to look only at the business aspects of the case and these may be summed up briefly as follows. Unity of Control and Unity of Thought. No sound business man would dream of splitting up his firm into two separate bodies. A hosier, for example, would not divide up his shop into two entirely rival compartments, 'A' selling heavy woollen underwear only, and 'B' nothing but light linen stuffs, and then appoint a buyer for the whole shop from 'B' department. The latter might be an absolute expert on linen wear but at the same time be hopelessly ignorant or out of date on the subject of Jaeger. Moreover the trade rivalry between the two would force 'A' to dangle absurdly cheap woollen garments before your eyes all the summer, whilst 'B' would tempt you with wonderful bargains in light linen wear all the winter.

If there are to be two separate Regiments of Artillery by all means let there be two, but they must have separate and independent heads at the War Office. This nightmare has been disturbing our repose for the past twenty years and now we have at least turned in despair to the physician and demanded a sleeping draught. And we are getting—What? Let us hope it will be Amalgamation. The separation of ideas is no longer Speed *v.* Accuracy, or Wits *v.* Slide Rule, but Animal *v.* Mechanical. The difference, however, remains a purely psychological one and has become of even less real significance. If anyone fears that the '*esprit de corps*' of his own particular branch will suffer let him take consolation in the reflection that from its birth in 1716 to its first serious illness in 1901, the Regiment maintained a very high reputation for '*esprit de corps*'.

And so we come down to the question of Departmental Organisation. Here our watchword must be "Co-operation with the other Arms". We have touched upon this already in discussing our relations with the Royal Air Force and the same idea applies with equal force to our relations with all the other branches of the service. It is, therefore, with this idea uppermost in our minds that we put forward the following suggestions for the re-grouping of our various departments. Remembering that "it is the advance of the infantry that alone is capable of ensuring decisive success in battle" (F.S.R. 1914, Sect. 145), we will endeavour to see how the various branches of the Artillery and the other auxiliary services may be most efficiently and economically fitted in to a general scheme of which the infantryman is to form the centre piece.

First, because the closest and most constant companion of the infantryman will be the Infantry Gunner, whom we may define as the artilleryman who can take his gun anywhere that the loaded infantryman can go and will thus be used in close support of the attack or defence. His weapons will include all Mountain Artillery and a certain number of Medium Trench Mortars adapted to 'pack' methods, and with him will naturally be associated the Horse Artilleryman, whose duty it is to provide close support to the cavalry when acting on detached duties. As already pointed out the Horse Artillery weapon might conveniently be made divisible into pack loads, for use in boggy or very hilly rocky country, and so, if we abandon the obsolete and somewhat misleading title of Mountain Artillery and substitute the words Pack Artillery, we get a useful

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generic title that embraces all those natures of weapon whose chief rôle it is to act in close support of the attacking or defending columns. We thus arrive at a First Line called Pack Artillery and sub-divided as follows: A—Horse. B—Foot. C—Trench Mortars (medium).

The next line will be the Field Artillery, from which we must now remove the Horse Artillery and at the same time add Heavy Artillery as described above, and the mobile A.A.C. batteries. Tanks too might form a part of the Field Artillery so that we get in this case four main sub-divisions.

A—Light. B—Heavy. C—Anti-Aircraft. D—Tanks.

The tank of course will act chiefly in close support of the attacking columns but its extreme mobility seems to us to render it so valuable as a mobile reserve in the hands of a Divisional Commander, that we have deemed it advisable to keep it out of the first line which must necessarily fall more or less completely under the direction of Battalion Commanders.

This completes the normal artillery establishment of the Field Army, but experience has shown that we must be prepared to back this up with a plentiful supply of heavy Siege Artillery, powerful enough to deal with any fortresses or strong points with which the enemy may endeavour to embarass its movements. This might be divided up into A—Road. B—Rail. C—Heavy Trench Mortars.

Finally we come to the purely defensive branch of the Regiment, maintained for the protection of our chief coastal fortresses. This might reasonably be termed Fortress Artillery and would comprise A—Fixed Armament. B—Mobile Armament. C—Anti-Aircraft.

We hope that in the foregoing description we have made clear the distinct and unbroken continuity of idea running throughout the whole system from the Fortress to the Pack Artillery. Co-operation with the other arms has already been touched on in several places but may be briefly summed up as follows:

In the Pack Artillery the Horse Branch will inhabit the same (or adjacent) barracks as the Cavalry, whilst the Foot and Trench Mortar Branches settle alongside the Infantry. During periods of training infantry battalion—or cavalry regiment—commanders must have practice in working with the guns and learn how to employ them to advantage, above all making full use of them as weapons of opportunity. They will then appreciate the fact that O.P's which are good for artillery will also be the best for themselves and the difficulty of maintaining close personal relations during the course of an action will be greatly reduced.

In the Field Artillery the Tanks will live near the Infantry and the Light, Heavy, and Anti-Aircraft branches near the Royal Air Force. Siege Artillery will associate with the other scientific branches of Army Troops and Fortress Artillery will of course establish sympathetic relations with the Royal Engineers and others engaged in such important tasks as running the lights, etc. of the defence scheme.

The closeness of the contact to be established in each case must naturally depend upon circumstances. We have not forgotten the ancient dictum that "Familiarity breeds contempt" and do not fail to appreciate the value of a due sense of modesty and reserve within

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the body politic, be it parent government or minor offspring. We would, however, insist upon a common room where occasional "rapprochements" might take place between the allied arms, and especially would we point out the necessity of establishing a true spirit of mutual sympathy throughout every branch of the Regiment itself. To do this we must not only have a United Gunner Policy, controlled by our central school at Larkhill, but a United Gunner Spirit, inspired by our parent mess at Woolwich (which perhaps might be moved with advantage to Larkhill).

Individual competition and friendly rivalry is a great thing but there must be no little Benjamins.

So far we have dealt mainly with abstract questions concerning the general organisation and control of the whole family of the Artillery. We must now devote the remainder of our attention to the individual, whom we may group for the purpose into three great classes—(1) Officers, (2) Gunners, and (3) Drivers.

Officers. We have already pointed out the desirability of allotting a fair percentage of vacancies each year to qualified members of the rank and file and to this we would add a note on the method of appointment of young officers from the Royal Military Academy to the various branches on receipt of their first commissions. With the Regiment once more a welded unity all officers will be borne on a General Artillery List and as far as possible every officer will be required to serve at some part or other of his career, in each of the four main branches. Especially will this be so in the case of officers desirous of entering any of the Regimental or General Staff Colleges. So long as this requirement is fulfilled officers should be encouraged to indulge their fancies and to specialize in some particular branch, and, on passing out of the R.M.A. the choice should be given in order of seniority. We hold that the system at one time employed of allotting vacancies in the R.F.A. to gentlemen cadets who headed the list in Riding and F.A.T. Subjects only is a vicious one inasmuch as many of the young men who pass through the "shop" nowadays go there without any previous experience of riding and therefore start at a serious disadvantage. Moreover it is common knowledge that horsemastership cannot be taught but has to be learnt by experience.. It is keenness and the Will to Win (as our German friends put it) that counts for most in this world and it is the keen man who will head the list as a rule for brains are largely made, not given. If the F.A.T. subjects bore a reasonable ratio to the rest of the curriculum we would not labour the point so much but they don't.

We feel sorely tempted here to indulge in a general criticism of our Public School and Army System of education, but space will not permit. We must, therefore, content ourselves with remarking that in the future we must teach the young to "Think before you speak". Multiplication tables, six tenths rules, and the like must give way to a system of well organised and controlled mental pictures. As someone correctly said "Wise men make proverbs (and he might have added tables) that fools may quote them."

Gunners. Perhaps no one has been so severely tried during the recent war as the unfortunate gunner, who has found himself called

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upon to undergo innumerable courses, furnish innumerable fatigues, and at the same time grapple with a growing complication in gun drill as the result of more scientific methods of shooting. As regards the latter difficulty, recent improvements in gun construction are likely to ease his position considerably. The use of Compensating Range Indicators will do away with the complication of varying gun ranges throughout the battery, whilst the automatic gun allows of still further reduction in the numbers in action with the Light Field and Pack Artillery. Finally it is to be hoped that our new Central School of Instruction, or the Competent Military Authority whoever he may be, will set about the immediate classification and co-ordination of gun drills throughout the whole Regiment. We are always being told that a bad drill known to everybody is better than the finest drill in the world known only to a few, and yet there are certain branches to-day in which scarcely two units can be found that carry out their drill alike, the difference in some cases being so great that a man sent as a reinforcement from one battery to another would be of less value than the latest joined recruit for he would not be content with being a mere passive spectator but would want to do things his own way.

Courses and fatigues will require a different form of treatment. The question of ammunition fatigues is now recognised to be of first rate importance and several competent judges seem to think the creation of special ammunition numbers the most advisable solution to the problem. It has been truly said that there is nothing new in history and if we turn back to the birth of the Regiment in the beginning of the eighteenth century we find a special class of men, called fireworkers, who were placed in charge of the ammunition. If then we are to revive this ancient duty, we could not do better than revive also the ancient title.

This leaves the Gunners free to tackle gun drill and Staff duties, which must at least include patrol work, flash spotting, signalling and all ordinary O.P. routine work. A highly technical R.A. Survey branch to include Sound Ranging, Flash Spotting, and all essential R.A. Survey work will no doubt be a necessity in the future but we do not agree with those who advocate a new Army Signal Corps to embody everyone employed as a regimental signaller as well as the present Signal Service. For O.P. work, etc., each unit must have its own signallers who are personal friends or acquaintances of the men at the guns.

In the future, then, we shall expect to see the sorely tried gunner split up into three distinct entities as follows. (1) Gunners. (2) Fireworkers. (3) Surveyors.

Drivers. So long as the horse remains an important factor on the battlefield our transport is bound to be of a dual nature, in which each component part differs widely from the other. We are of opinion that this difference ought to be recognised by the authorities by the creation of two distinct classes to be known as drivers and mechanics respectively. In the immediate future much confusion might be avoided by employing horse transport for all Pack and Field Artillery weapons (except of course the 9·2) and mechanical transport for the remainder.

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In conclusion we would devote a few words to our Circulatory System, by which officers and men are given periodical changes of air and outlook without the expense of moving whole batteries. Under the present system a man returning from abroad with only one or two years service to complete may find himself posted to a unit armed with an equipment that is absolutely strange to him. This is neither economical for the Government nor helpful to the B.C. since it is not in human nature to display keenness and enthusiasm in one's work under such conditions.

By the simple method of confining certain groups of regimental numbers to certain branches the authorities could easily keep themselves informed of the surpluses or deficiencies in each branch, and during the trooping season Dispersal Officers and Battery Commanders would know at a glance whether they had got hold of the man they wanted. An even better method would be to institute linked Artillery Brigades amongst the Home and Overseas forces in the same way that Infantry have linked Battalions. This of course would not apply to the distribution of officers, who would still be required to have some personal experience of each of the four branches, nor would it interfere with the seconding of certain officers to Survey Units or Indian Mountain Artillery as occasion demanded.

But these are minor points of detail that can well wait till we have achieved that Unity of Control and Unity of Idea which is vital to the health of the political, no less than the physical, body.

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CALIBRATION AND RANGING.

By Major H. C. Harrison, D.S.O., R.M.A.

(A few comparisons between Navy and Army.)

CALIBRATION.

IF there are two factors affecting the service of his battery which appear ultra important to the regimental officer in view of the lessons learnt during the war, they are those of calibration and ranging, particularly the former.

Battery officers have been so tortured during the war by the continual variation in pattern of driving band, nature and size of propellant, that the ever increasing demand for accurate "blind" shooting caused calibration to assume the form of an almost overwhelming nightmare. The B.C. looked everywhere for inspiration as to some practical solution of the problem (other than the plaintive demand for *one* projectile, *one* driving band, and *one* propellant) and a few, remembering that calibration has always been reported as having been initiated in the Navy, wondered if the latter had a solution. And so it is possible that a few remarks on calibration in the Navy and Army may not be entirely without interest.

For many years before the war, the guns of every first-class ship in the Navy were calibrated annually on a special range, a day as nearly normal as possible being selected, and "screen M.V's" reconciled as nearly as possible to "fall of shot M.V's". The object of calibration was to "tune" all guns as closely as possible to the Range Table. Only one or two very short full charge series were fired during the year, and the effect of wear hardly made itself felt.

With field artillery there was hardly any suggestion of calibration. A new gun had a certain known M.V., the range table was made out for a part-worn gun in some cases, and it was not anticipated that the gun would wear rapidly. Moreover, observed shooting alone was considered, and maps, accurate to within five yards, were not foreseen as being available in war-time.

Such then was the relative position in 1914.

It is unnecessary to recapitulate the various successive steps which the war has taught the B.C. The text books urge that every B.C. in the field must now be checking the M.V's of his guns continuously, using every series in which his guns have been accurately ranged on to a target whose range is known, and admirable results were obtained by this means, until the tactical demand of "blind" shooting and batteries to be kept silent until the moment of an attack meant the firing of many thousands of rounds without observation and consequent checking of M.V's. This caused a hark back to "screen M.V's". "Screen M.V's" were naturally found to be valueless in the case of guns other than new pieces, owing to loss of

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steadiness due to wear. A series of experiments with guns in all states of wear was effected, and pointed to the possible establishment of a factor for a particular piece in a particular state of wear, whereby the "screen M.V." could be converted into a "fall of shot M.V.".

And so it is possible that the war of the future will provide the artillery group commander with a portable pair of screens or a solenoid the time interval being measured by the same device as used in Sound-ranging, or by "wireless valves", whereby the "screen M.V." will indicate a particular factor which will itself establish a "fall of shot M.V.".

In the Navy, battle practice had, up to 1913, been carried out at a range of 8,000—10,000 yards. In that year an experimental firing at a range of 18,000 was carried out. During the war, the fleet actions invariably opened at a range of 18,000—20,000 yards or more.

Analyses of practice firings at sea throughout the war gave the most conflicting results when deducing M.V's, and the question of wear became all-important. The reason was obvious: the ranges were so long that the projectile spent half its time of flight in a stratum of air in which anything but a computed meteor report was out of the question. Calibration, in that it meant the tuning of a gun to the range table gun, became impossible, nor, moreover, did it seem essential, seeing that all shooting was likely to be observed shooting. The Gunnery Officer was usually content to tune his guns the one with the other so that he could range with a broadside.

Then came the institution of methods of ranging whereby the fall of shot of the guns of one ship were used for a "spotting correction" to those of another ship. This necessitated the "inter-tuning" of the guns throughout the squadron, and the best solution of the latter problem was found to be in deducing by bore measurements the state of wear of the gun and, by means of such measurements and the numbers of E.F.C's fired, grouping the guns of a squadron into one homogeneous group.

Thus it may fairly be stated that whereas, with artillery in the field, the need for calibration, whether by screen or by fall of shot, is of paramount importance, its only practical value afloat lies in the grouping of the guns of a squadron based upon bore measurements and equivalent full rounds fired. Truly an upheaval from pre-war notions.

RANGING.

When trying to obtain comparisons between ranging afloat and ashore, the primary impressions recorded on the mind are, firstly, the dissimilarity of conditions and, secondly, the apparent lack of value in seeking such comparisons. It is true, moreover, that no interchange of views on the subject between regimental officers of the two services is encouraged officially nor is there any committee or formation where the two services function together lower than the Ordnance Committee, and yet the conditions are by no means so dissimilar as one would think, and the fact that, so far as ranging is concerned, the two services have arrived at almost exactly similar methods is at the same time surprising and interesting.

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In the field, the war has taught us that pre-war notions of ranging are still the best. The battery commander has received new kinds of assistance in *observation*, it is true—from aeroplanes, balloons, field survey sections, and sound ranging sections, but the *methods of ranging* are still the same, viz:—

(a) Single gun, or "gun on gun", ranging.
(b) Section ranging.

In both, bracketting is the essential feature, except when observation affords an exact measure of displacement from the target, when "M.P.I." ranging is tolerated.

With regard to the Navy, method (a) was the sole method used until 10 years ago when it was modified to the extent of firing salvoes, ranging with a bracket of approximately 400 yards until the target was bracketted, and subsequently "splitting" until "straddles" were obtained. It is worth noticing that the method depends for success on the guns being "tuned" together, though not actually calibrated to the range table again. (N.B.—It is never possible to entirely dissociate the subject of ranging from that of calibration).

This method proved too slow: initial salvoes were frequently so far displaced (for reasons common to both services) that valuable minutes ensued before straddles were being obtained. A new method had to be evolved. This method proved to be that known for so long to the field gunner as "section ranging." The fire of a squadron is used, and the place of the section commander is taken by a special short distance wireless set, all ships of the squadron working on the same wave length. The fire of the squadron is controlled from one ship and opens with a salvo from one ship at a given range, followed a few seconds later by a salvo from the same or a second ship at a range differing by a prearranged amount (normally 400 yards) from that of the first.

Should these two salvoes fail to produce a bracket, two more are fired with altered ranges on a prearranged plan, each ship being able to hear the range at which all other ships are firing. When the target is bracketted with a pair of salvoes "battery fire" or "gun fire" can be opened at the mean.

Thus, where the time of flight is 40 seconds, six salvoes, at ranges differing by 400 yards—the whole covering a scope of 2000 yards, can be fired in 4 minutes, followed by the concentrated fire of the guns of the whole squadron.

The method is usually known as that of "laddering", but the field gunner will readily recognise his own "section ranging". Here, again, it is worth noticing that the method depends upon the guns of the *squadron* being "inter-tuned", though not necessarily calibrated to the range table gun. The grouping of the guns of the squadron by means of bore-measurements was remarked upon previously when talking about calibration.

Indirect laying for line and elevation is now obtainable afloat, and alterations on range due to course and speed of own ship and course and speed of enemy ship can be continually applied to the sights in much the same way as the land gunner applies "gun

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position corrections" to the sight clinometers in the case of non-shrapnel firing guns and howitzers, i.e. independantly of the "main" elevation which is in the hands of the observing or ranging officer.

The employment of aeroplane observation in fleet actions is receiving much post-war attention, and it is sincerely to be hoped that that long-suffering and all-important aid to the gunner afloat and ashore—the airman-observer—will be allowed to work on one system, and one system only, afloat and ashore. No one wishes to see him suffer the fate of the chameleon on the scotch plaid, and there is danger that the valuable work perfected between the land gunner and the airman during the war may not be used to help the gunnery officers afloat.

Let is be realised that the gunnery problems afloat are not so very different from those ashore, and let the "regimental" officers of both services do their utmost to exchange views and experiences on these all important subjects.

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SOME ASPECTS OF GREAT CAMPAIGNS.
I.—1914 IN THE WEST.

By Major R. G. Cherry, M.C., R.F.A.

INTRODUCTION.

In the study of the campaigns of the last hundred years, one of the most salient features is the frequent recurrence of similar problems, and the comparison of the ways of the different commanders tackled these problems is, for the student of military history, of absorbing interest.

Notwithstanding the modifications in methods caused from time to time by modern inventions and improvements in armament, each campaign and each battle has been won by adherence to certain rules evolved by the great leaders of the past, and by adapting to modern conditions their methods of solving the strategical and tactical problems that have arisen.

Nor did the campaigns of the late war form exceptions, or refute any of the great principles of the conduct of war. Some of these principles, it is true, were modified by changed conditions, by the vast scope of the operations, by the world interests involved, and by the introductions and development of hitherto unknown weapons and machines, but the success of campaigns depended, as in the past, on the soundness of the strategy employed.

In this war, national life and interests were actively involved to such an extent that the leaders in the field had the greatest difficulty in preventing their conduct of the operations from being unduly influenced by Press and Politician, to both of whom a striking tactical success was preferable to a sound strategic plan.

While our knowledge of the main incidents of the campaigns, from the Entente point of view, is fairly complete, yet such prominence was given throughout the war to incidents of sentimental importance, and such a flood of literature in the form of anecdote and "history" poured from the pens of novelists and military correspondents, that the real strategic value of such events has been frequently magnified, while the really decisive movements and episodes have been overshadowed.

On the other hand, our knowledge of the campaigns from the point of view of the Central Powers is by no means complete and is at present mainly obtainable from the bulletins issued at the time by the German General Staff, or from a flood of personal reminiscences, both unreliable as a basis for historical appreciation.

Criticisms, therefore, that are perforce based on imperfect knowledge, must themselves be imperfect and will be subject to modification if and when the campaigns can be studied dispassionately from complete official publications made by the General Staffs of all the Powers concerned in the conflict.

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Initial Strategy.

The requisites for the successful prosecution of a campaign can be summed up briefly as The Man, The Men, and The Moment: that is to say, in superior generalship, superior numbers of superior troops, and the moment most favourable for their employment.

The German General Staff, who were responsible for the inception and prosecution of the war, considered that in themselves they could produce superior generalship, based on a profound study of military history, superior numbers of first rate troops armed with superior weapons, especially in weight and strength of artillery; and they were able to declare war at a moment which, from a survey of the political horizon, appeared to them most favourable.

Throughout the struggle, the Central Powers were compelled by their geographical situation to operate upon Interior Lines, while the Entente Powers similarly acted upon Exterior Lines. The experience of history has been that it is the force acting on Exterior Lines that usually assumes the offensive rôle both in Policy and Strategy, but in this case it was not so.

The first strategic problem to be solved by the force acting on Interior Lines is "Which adversary to contain and which to crush"? The solution here was not difficult in view of the slowness of Russian mobilisation, the paucity of Russian strategic railways and the consequent delay before Russia could complete her strategic concentration and make her weight felt.

France, on the other hand, was known to be able to mobilise and concentrate almost as soon as Germany, although her available troops would be fewer by at least half a million than those that could be put into the field against her.

It had been, therefore, decided to contain Russia with a force of about half a million first and second line troops, in addition to the bulk of the Austrian forces, and to overwhelm the French armies with superior numbers before the Russian strength would call for a transference of weight from the west to east.

The next strategical problem lay in the method to be adopted in crushing France with the least possible delay: Time was, therefore, a most important factor, and a plan had to be sought that promised a quick decision. A glance at the frontiers from the Dutch to the Swiss borders shows two probable avenues of invasion from the east. (1) Between Maestricht and the Ardennes. (2) Between the Ardennes and the Vosges. These approaches are both well served by strategic railways, and as they debouch into French territory, by good roads and lateral communications.

The northern approach was at the most vulnerable portion of the French frontier, owing to the fact that France, not expecting the violation of Belgian territory, had not seriously fortified her frontier on the Belgian side. The position of the Ardennes would form a screen behind which an invading force could conceal its strength from air reconnaissances.

Invasion, with the bulk of troops operating on this wing, would threaten the opposing forces in this theatre with strategic envelopment.

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An advance on the Eastern portion of the front, through Lorraine, would involve a frontal attack in order to achieve strategic penetration.

To meet this, the French had protected this part of their frontier by a strong chain of fortresses from Verdun to Belfort, and had planned their strategic concentration in this area. From the German point of view the key of this position was the gap of Mirecourt, some 50 miles wide, between the fortresses of Toul and Epinal, protected by the Grand Couronne de Nancy.

Initial German Plan.

Actually the Initial German Strategic plan was to focus all eyes on Belgium by violating its neutrality and attacking its fortresses, to lure large forces north of the Meuse to envelop and destroy them there. Then to wheel with their strong right wing through Belgium and Northern France, turn the French fortresses on the Lorraine front and drive the French armies away from Paris to the south.

German Concentration.

To effect this, the German armies were grouped as follows: 1st army, Von Kluck, 5 corps, and 2nd army, Von Bulow 4 corps, between the Dutch and Luxemburg frontiers. 3rd army, Von Hausen, 4 corps (including the Prussian Guard Corps) behind the Ardennes. 4th army, Duke of Wurtemburg 4 corps east of Luxemburg. 5th army, Crown Prince, 7 corps between Luxemburg and Metz. 6th Army, Prince Rupprecht of Bavaria, 5 corps and 7th army, Von Heeringen 4 corps between Metz and Neu Brisach with detachments to the Swiss frontier. Of these armies, the 3rd under Von Hausen, had been officially earmarked for the Polish frontier and its appearance on the Western front came as a surprise to the Allied Command. It will also be noted that the army of the Crown Prince was the largest, and was not likely to be reserved for operations of secondary importance.

German 1st Line Corps had three divisions, and 2nd Line Corps two divisions. The total number of divisions employed by them in the Western front at the outbreak of hostilities was, therefore, 90, with 10 cavalry divisions.

Initial French Plan.

The intention of Joffre, the French Commander-in-Chief, was to take the offensive with the whole of his forces on a united front, and to avoid premature engagements by isolated units. The main attack was to be made through Luxemburg and a secondary attack between Metz and the Vosges.

French Concentration.

The French initial concentration was in four armies, the 5th, 3rd, 2nd and 1st in order named between Mezieres and Belfort, with the 4th army in rear, South-East of Chalons. As the strength of the German concentration on the Northern front became evident, the zone of concentration was enlarged to the North, and the fourth army came into line between the 5th and 3rd. The total strength of the

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French armies and detachments was about 70 infantry and 10 cavalry divisions. In addition, the Belgian army had five Infantry and one Cavalry divisions based on Antwerp, and the British six Infantry and one Cavalry division.

Opening Moves.

The German concentration that was most threatening at the moment was that opposite Nancy, the defences of which were not yet complete.

Accordingly, to divert German troops from that neighbourhood, part of the 1st army on August 5th invaded Alsace, defeated the weak force at Altkirch and captured Mulhouse. A swift counter-stroke by troops from Neu Brisach defeated the French, who were forced to retire over the frontier.

Simultaneously with the start of this offensive, Von Bulow attacked Liege, captured the Southern forts and entered the town on the 7th. The northern forts, however, which commanded the railway, held out and were not reduced until the 15th when they were demolished by heavy howitzer fire. Nothing further was done by the 1st, 2nd or 3rd German armies, except strategic reconnaissances, until August 20th.

Development of French Strategic Plan.

Meanwhile Joffre had been steadily moving the 5th, 4th and 3rd armies up towards the Belgian frontier along the Meuse, and by August 14th when his strategic concentration was completed, he had 18 corps watching the Belgian frontier, 11 watching Lorraine and Alsace, while the British Expeditionary Force had landed and was concentrating near Maubeuge, and the Belgian army had taken up a defensive position covering Antwerp. He had guessed with considerable accuracy the position and intentions of the German forces, but he had failed to locate the presence of the 3rd (Saxon) Army in the Ardennes. His plan was to attack vigorously South of the Ardennes through Luxemburg with the 3rd and 4th armies, while the German right wing was held up by the 5th army, the British and the Belgians north of the Sambre and Meuse. A secondary offensive was to be opened first by the 1st and 2nd armies against Alsace and Lorraine, to attract German reserves to their left wing and so weaken their centre and right.

The more German troops that were deployed south of the Moselle or north of the Meuse, the more effect would be caused by the French thrust at the German centre.

French Offensives on the Frontiers.

On August 19th, Pau with three corps forming the army of Alsace and operating from Belfort attacked and routed three German Corps in Alsace, and was master of Upper Alsace and its bridges over the Rhine. In the Vosges, Dubail's First Army of 4 Infantry and one cavalry corps had by the same date captured the Donon height, and was astride the Sarre below Saarburg.

Simultaneously de Castelnau, with about four corps, had driven the Bavarians over the Moselle and Seille, and was preparing to attack their strong defensive positions between Metz and Strassburg, covering the railway.

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The Germans had, however, as Joffre had anticipated, concentrated large effectives to counter this offensive, and on August 20th the Bavarian army allowed Castelnau to attack and when his attack failed under intense machine gun and howitzer fire, launched a very powerful counter-attack against his left and drove his army back to Nancy and the Meurthe. Dubail who had been checked by Heeringen on the Saar, fell back hastily to conform, in time to prevent a German break through in the Mirecourt gap.

On the same day that the French Lorraine offensive was stopped, the German right wing in Belgium moved forward and Kluck attacked the Belgians in front and on their left flank, with the object of cutting them off from Antwerp. In this he failed and the Belgian army, compelled to give way before the frontal attack, fell back on that town where Kluck masked it with one active and one reserve corps.

Bulow, on Kluck's left, moved forward north of the Meuse and on the 20th attacked Namur, which was weakly held by Belgian troops, while Hausen advanced towards the line Namur—Givet.

On the 21st the French 4th and 3rd armies under Generals Langle de Cary and Ruffey, with 10 corps, crossed the Meuse between Sedan and Longuyon and advanced against Wurtemburg and the Crown Prince. The battle took place north of the Semoise and resulted in a French reverse; the corps in the centre were badly handled, and the general result was that the French fell back to the frontier, and assumed the defensive. This German success was mainly due again to superior tactics, better handling of machine guns, co-operation between aircraft and artillery. The numbers engaged on both sides were about equal.

Situation on Allied left.

Lanrezac's 5th army, which had been reinforced, was holding the angle between the Sambre and the Meuse between Thuin and Dinant. On August 22nd this angle formed a salient, with Hausen on its east and Bulow and Kluck on its north flank. Now the possession of a salient confers advantages, provided that the army occupying it holds the bridgeheads and is able to assume the offensive. It can hold up the enemy on one flank by blowing up the bridges, and destroying by artillery fire the enemy's pontoons where he attempts to cross, while it holds the other river strongly on both banks with strongly fortified and held bridgeheads, from which it can issue to deal the counterstroke. Joffre's plan, based on his assumption that six German armies were operating against him, did not preclude offensive action. Lanrezac could have held the line of the Meuse defensively, and the line of the Sambre offensively, and so isolate the German corps north of the Sambre and north of the Meuse below Namur. These he would then attack with the bulk of his army and the B.E.F., while the Belgians took the offensive from Antwerp. The holding of this salient position defensively was not favourable, as there would be grave risks of envelopment—in fact it would be playing up to the German plan.

The unexpected appearance on the Meuse of Hausen's complete army made the success of an offensive doubtful, but Lanrezac's defeat was due to the Germans attacking before his own force was concen-

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trated. His army consisted of four active corps, three reserve divisions, three cavalry divisions and three divisions of African troops. On his left and on the north bank was the B.E.F. of four infantry and one cavalry division.

Battle of Charleroi.

Lanrezac had apparently failed to appreciate the situation, for he did not fortify any of the bridges, nor prepare to hold Charleroi, the key to his northern front, except with a few advanced troops. Neither were any of the bridges over the Meuse fortified, held in strength, or destroyed. He held a diagonal line defensively between the two rivers, until all his corps and the British arrived, thus losing all the advantages from the salient and exposing himself to the combined attacks of Hausen and Bulow. On the 21st, as he was issuing offensive orders, he was attacked by Bulow, and lost the crossings of the Sambre. If Bulow had not attacked prematurely, the French 5th army would probably have met with a disaster: as it was, it withdrew its northern front before Hausen could cross the Meuse. Thus, although the French had evaded the German blow by refusing to be lured into Belgium, yet their own plan had failed, and their own left was now threatened with envelopment north and west of the Sambre. From the German point of view, their initial plan had failed, in that the French had not unduly weakened their centre, and their left, though defeated, was not isolated or crushed. The German right was now, however, in a position to envelop the Allied left, in particular to crush the B.E.F. now in position on the left of Lanrezac's army. On the afternoon of the 23rd the British were engaged by part of Bulow's 9th corps, the advanced troops of his 7th corps and the advanced troops of Kluck's 4th corps, while Kluck's 2nd and 2nd Reserve corps were moving down from Tournai and Courtrai.

It should be noticed here that the secrecy with which the B.E.F. effected its concentration left the German Command in doubt as to its whereabouts. In fact, after Kluck had driven back the Belgians at Louvain, he was looking for the British with two corps on the line of the Scheldt. These corps only met a few French territorials and were too far off to be available on the 23rd.

British Retreat from Mons.

Information from Joffre, confirmed by aerial reports, showed Sir John French that he was in imminent danger of being exposed on his right by the retirement of Lanrezac's left, and outflanked on his left by Kluck. He, therefore, broke off the action, and retired south and west of the Sambre.

On the following day the French 5th army counter-attacked on its whole front, thus taking pressure off the British right.

Situation on August 25th.

On the 25th, the position from north to south was as follows:—

On the extreme left, a corps of the new 6th French army was forming in Picardy, which was moving north-east from Arras, and on this day defeated Kluck's cavalry division near Bouchain. Sordet's French cavalry corps was moving to the west behind the British, so as to link up the British left with the 6th army.

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The British left, reinforced by one division, was retiring on Le Cateau, and the British right was crossing the Sambre south-west of Maubeuge. The 5th army, defeated in the salient, was retiring on the line Avesnes—Givet. Opposite this army, Bulow's right and Hausen's corps were sorting themselves out of the confusion caused by their converging movements into the salient. Further south, Langle's 4th army was falling back before Wurtemburg to the Meuse, and Sarrail, replacing Ruffey in command of the 3rd army, after checking the Crown Prince's centre near Virton, had fallen back to the line of the Othain.

On the Lorraine front, the pursuit of the Bavarians and Heeringen, who were trying to force the Mirecourt gap, had been brought to a standstill on the Meurthe, and a counter offensive by Castelnau's centre had been launched on the 24th, and was threatening the Bavarian right with envelopment. The success of this blow caused both armies to fall back to the frontier.

The Belgian army based on Antwerp had, on August 24th, taken the offensive, and gained initial success, but Kluck called up reserves from Brussels and thrust it back to its defensive positions during the next two days. The Belgian offensive which would probably have had decisive results in the event of a Franco-British victory on the 23rd or 24th, had the effect of indirectly taking pressure off their allies during the early stages of their retreat.

Battle of Le Cateau.

On August 26th the British left was forced to stand and fight at Le Cateau. Outnumbered in the proportion of 3 to 7 in Infantry and 1 to 3 in Artillery, they held on till the evening and were then skilfully withdrawn before Kluck could complete the envelopment of their flanks. In this action they received no support from the British right, which was separated by the Sambre and in no condition to make a flank march to its assistance, nor from Sordet's cavalry corps which was exhausted, but they were indirectly helped by the French reserve corps based on Arras, against whom Kluck had to detach the bulk of his 2nd corps which would otherwise have encircled the British left.

This action, tactically a British defeat, was in reality a considerable strategic success, as it held up the movements of the German right and so caused the failure of the second German plan when the conditions were most favourable to its success. The allied left, falling back on to reinforcemenets, was not afterwards in such danger, and from this date began Joffre's deliberate strategic retreat to the Marne.

At the same time, had the British 2nd corps been overwhelmed and surrounded at Le Cateau, the position of the British 1st corps on the south of the Sambre would have been precarious and it would have been pushed off its line of retreat down the Oise. The envelopment of the allied left would then have been accomplished.

Had the Commander of the 2nd corps been able to retire on St. Quentin, and avoided giving battle at Le Cateau, he would not have run the risk of being surrounded with both flanks in the air, as touch would have been regained with the 1st corps on his right and Sordet's cavalry corps on his left.

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On the 27th, the Allied retreat was carried out on the whole northern front, and by the 4th army, who were now in danger from Hausen's left which was advancing up the west bank of the Meuse. Langle fell back over the Meuse followed by Wurtemburg.

On the German extreme right, Kluck's 2nd Reserve Corps was marching on Amiens, his 2nd Corps was checked by the French Reserve Corps south of Cambrai, his 4th corps with Bulow's 7th, 9th and 10th were pushing down to the Oise, with Hausen on their left following up the 5th army.

French Counterstrokes—August 28th.

On the 28th Joffre delivered two counterstrokes that materially checked the forces following up his left wing.

The sorting out process of the German corps in the angle of the Sambre and Meuse had led to an edging out from the centre, especially towards the right enveloping wing. The result was that when the French 5th army fell back over the Oise on the 27th, they were only pressed on their left by Hausen's right corps, the Guards.

Accordingly, D'Esperey, who had replaced Lanrezac, saw his opportunity and struck the Guards heavily in the flank at Guise, and simultaneously dealt a frontal blow against Bulow's left east of St. Quentin.

This reverse to the Prussian Guard held up the other corps of Hausen's army and enabled the 4th French army to strike at Wurtemburg who was crossing the Meuse. This blow was completely successful and the Wurtemburgers were forced back over the river with loss.

At the same time the Crown Prince followed up Sarrail and endeavoured during the next few days to cross the Meuse and isolate Verdun.

The results of these French counterstrokes were, to enable the advanced troops on the Extreme left to fall back on to and join the 6th army, to take pressure off the British corps, and to allow the retreat of the 5th and 4th armies to be carried out from Verdun to the west during the next few days without important incident. Rearguard actions took place along the whole front, but no portion of that retiring front was cut off, forced to fight, or indeed unduly menaced. The reverse suffered by the 2nd German army caused the 1st army to wheel to the left in order to threaten D'Esperey's left and rear. From then, the 6th army were ignored by the 1st army which directed its march due south and then south-east.

German attacks on Nancy. August 30th—September 11th.

From the date on which the Allies fell back from the line of the Somme and Oise which the Germans expected them to hold, the latter turned their chief attention to the Eastern theatre in a series of violent attacks on the Grand Couronne de Nancy. The tactical objectives were the capture of these positions and of the town, followed by the investment of Toul. The strategical objectives were firstly to attract a large number of French effectives and so weaken the French left wing in its retirement, and, secondly, to open the way for the isolation of Verdun from the south, and the rupture of the French line about St. Mihiel on the Meuse.

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Joffre, in anticipation of this move, had stopped the counter attacks of the French 1st and 2nd armies which were pushing the Bavarians back from the line they had reached on the 24th, and he instructed Castelnau to fortify the defences of Nancy as strongly as possible, and to hold those defences to the last man. The French tactical dispositions were so skilful that Castelnau was able with less than three corps to hold up and inflict the most sanguinary losses on eight corps. The climax of the battle was reached on September 6th when assaults in mass were delivered in the presence of the Kaiser without any success whatsoever. On the 11th the Germans made a final surprise assault which failed, and then withdrew discomfited.

End of the Retreat. Allied and German dispositions Sept. 5th.

Meanwhile the allied forces in the centre and left had, by the evening of September 5th, reached those positions from which they were to make their counterstroke. The right flank of these positions rested on Verdun, where Sarrail's 3rd army faced the 5th German army under the Crown Prince, and disputed the crossings of the Meuse between Verdun and St. Mihiel. His left flank was near Bar-le-duc, in touch with Langle's 4th army which was on the south bank of the R. Saulx facing Wurtemburg's 4th army. On his left a new army had been formed under Foch and faced Hausen's 3rd army about Fere Champenoise. This army, actually the 7th, was called in the communiques the 9th. On its left d'Esperey's 5th army was astride the upper reaches of the Grand Morin facing Bulow's 2nd army and in touch by its cavalry with the B.E.F. who were south of that river near its junction with the Marne. In the eastern and northern outskirts of Paris, the 6th corps under Manoury was now concentrated.

Kluck's march to the Marne.

The moves of the German enveloping army—the 1st under Kluck—are at this period most important.

This army had lost touch with the reserve divisions of the 6th French army, which had suffered severe losses north of the Somme, and had retired, apparently on Paris.

Kluck, therefore, on crossing the Oise about Compiegne, had directed his march south from south-west and was now following up the B.E.F. His objective was still the envelopment of the French left wing, and it was obvious that until the allied armies could be brought to battle and defeated, it was not sound to attempt to enter or invest Paris. He, therefore, again deflected his columns south-east, and on crossing the Marne near Meaux, pushed forward his cavalry to watch the British and directed his leading corps, the 2nd, against d'Esperey's left. Thus instead of being echeloned behind the 2nd army, in order to protect the German right and rear, as per instructions, he was echeloned in front of the 2nd army, and was exposing his own right flank and rear to the 6th French army.

French strategic plan.

Before discussing the battle that followed, it is necessary to consider the plan of the Allied Commander-in-chief.

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The assumption of the strategic defensive was imposed on the Allied command, as has been seen, in the first place by their numerical inferiority and the necessity of waiting on the development of the German plan; in the second place, by the failure of the operations on the Sambre and Semoise. At the same time, Joffre had not lost the initiative, that is to say, the power of subordinating the enemy's will to his own: this initiative he had captured by his first Alsace offensive, kept by his Lorraine offensive, and by his refusal to move into Belgium, temporarily lost it at Charleroi, but regained it by his deliberate retreat from the Oise, which lured his opponents into positions from which he was about to overthrow them. The commander who acts on the strategic defensive does so with the object of either gaining time or of falling back on to new positions from which he can assume the offensive, either relatively stronger in numbers, or from superior strategical and tactical positions.

In this case Joffre wished to gain time in order to form his 6th army, and he was reaching strong positions; reserves in the form of Foch's army were there to strengthen his centre, and his successful defence of Nancy had enabled him to pin down five more enemy corps than he was employing there.

The plan was to strike Kluck's right and rear with the 6th army, whose objective was the line of the Ourcq, to take his leading corps in flank with the B.E.F. and in front with d'Esperey's left. The remainder of the 5th army would drive back Bulow.

It was thus hoped to cut off the German right wing and destroy at least its right corps between the Ourcq and the Marne. Foch, Langle, and Sarrail were to assume the offensive against the armies in their front and drive them back, as soon as the flanking movement had developed.

Battle of the Marne. Manoury's attack.

Unfortunately, the plan miscarried in its opening stages: whether Manoury advanced too quickly, or whether Kluck received warning by air reconnaissance, or other means, of the danger to his right, is not certain, but the great flank attack did not have the great success it was expected to achieve. Kluck withdrew his 2nd corps, which had then crossed the Marne and was marching across the British front, and left his cavalry supported by infantry detachments to delay the British should they attempt to advance.

He then opposed Manoury in front with his 2nd Reserve Corps and attacked his left with his 4th and Bulow's 9th Corps about Betz and Baron.

Taking the operations from September 6th to 9th on this flank: Manoury's left and centre were very hard pressed, and very nearly outflanked and driven back on to Paris: his right in conjunction with, and materially helped by, the British left forced its way slowly from Meaux to the junction of the Ourcq and the Marne and along the south bank of the Marne. The British, keeping in touch with the 6th army, on its left and the 5th on its right, forced the passages of the Grand Morin Petit Morin, and were on the 9th forcing the passages of the Marne in face of comparatively slight opposition. The French 5th army had made a successful surprise attack on the

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night of the 5th—6th at Montmirail and during the next three days forced Bulow, who was weakened by the despatch of the 9th corps to the extreme right, back to the Marne.

The progress of the British was actually the chief cause of the German strategic defeat. Their passage of the Marne laid open a wide gap between the German 1st and 3rd armies, which could not be filled for two reasons: firstly, Kluck was committed to the battle against Manoury with all his effectives: secondly, the German right wing had been denuded, during the last few days, of two corps and a cavalry division, which had been sent to the east against Russia. The orders for the retreat of the 1st and 2nd armies were issued from Bulow's headquarters at 2 p.m. on the 9th.

German thrust at French centre September 7th.

The strength of the French turning movement against Kluck, together with the desperate resistance of Castelnau at Nancy, convinced the Germans that Joffre must have weakened his centre in order to reinforce his wings.

Kluck's success in holding up the French extreme left, encouraged the High Command to strike hard at the French centre between Fere Champenoise and Vitry-le-Francois. Here Hausen's 3rd army and Wurtemburg's right was facing Foch's 9th army and Langle's left, who were decidedly inferior in numbers. The blow was aimed at Foch's centre and right with a view of driving a wedge between his army and the army on his right, and rolling up the former between the Morin and the Aube. Success would compel the retirement of the French left wing, which would then be driven back on Paris between Kluck's right and Hausen.

To counter this blow, Foch had the equivalent of three corps against Hausen's four. In the battle that ensued he employed the most brilliant tactics: falling back slowly on his right and centre, he compelled Hausen to concentrate three of his corps against strong defensive positions and to leave his right flank exposed to the high ground west of Fere Champenoise. On the night of September 8th —9th, he transferred a division to his left flank, and on the following morning assumed the offensive on his whole front. While his right and centre held the enemy in front, his reinforced left crashed into their exposed flank. The whole of Hausen's army was involved in this disaster and was driven back over the Marne.

Foch then turned his right corps against Wurtemburg's exposed left, and that army was driven back through Chalons and Rheims.

It remains to recount the second Belgian offensive from the Antwerp position and the action of Sarrail's 3rd Army which was with 10 divisions opposed to the Crown Prince's 15 divisions in the Argonne.

2nd Belgian Offensive.

The second offensive of the Belgian army covering the Antwerp defences was provoked firstly by the allied successes in the early stages of the Marne battle, secondly by the inaction of the German forces that were containing it, and, thirdly, by the German atrocities in the occupied districts.

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On September 8th it advanced on its whole front and driving back the weak covering troops in its front, reached a line Alost—Louvain. Here it met strong opposition and suddenly, on September 12th, found its right flank menaced by a German army corps concentrated north-west of Brussels, while the equivalent of another corps advanced rapidly against its left rear and very nearly cut it off from Antwerp. Simultaneously the Belgian cavalry on its left flank were thrust back by a superior force of German cavalry.

The Belgian army thereupon made a long night march and succeeded in reaching the Antwerp defences.

The only effect of this sortie was to divert about a corps from the French front and to make the Belgian command very cautious. Against that must be set the disappointment caused to the Belgian nation and the narrowness of the escape from a very cunning German trap.

1st Battle of Verdun, September 8th—11th.

The third French army had fallen back, as previously stated, and was in touch with Langle on the left near Bar-le-duc. Its right flank was, however, in a most dangerous and exposed position.

Not only had it to cover Verdun with detached troops, but it had to protect the crossings over the Meuse in its right rear. Besides which, it was not properly in touch with the left of the 2nd army near Pont-a-Mousson. Its danger was probably greatest on August 30th, when a corps, actually marching from Metz to force the Meuse at St. Mihiel, was diverted to attack the extreme left of the 2nd army. During the first few days of August, Sarrail fell back through the Argonne, while the Crown Prince pressed him in front with one corps, and with two corps forced his right centre up the Meuse to Troyon. Meanwhile other German divisions pushed down the east bank of the Meuse, invested Verdun from the east, and tried to force the Meuse at St. Mihiel.

The French army was on September 7th in a very perilous position: if it failed to maintain its positions, it would be forced to leave Verdun to its fate and expose either the flank of Langle or that of Castelnau to envelopment.

Sarrail's Counter-attack September 8th.

Relief lay in counter-attack, and on September 8th, Sarrail struck with two cavalry corps against the forces who were crossing the Meuse on his right rear, and drove them back. With his left he drove the Germans back into the Argonne forest.

On September 10th the Crown Prince made a desperate attempt to counteract the French victories in the west by the capture of Troyon and so complete the isolation of Verdun: in doing so he exposed his flank to Sarrail's left and left centre which attacked and threatened to pin him against the Meuse. The Crown Prince's army fell back to a fortified line north of Verdun, joining up with Wurtemburg's left on the Upper Aisne.

Comments.

This action completes the series of battles known as the battle of the Marne which resulted in the complete overthrow of the

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German plans for the overwhelming of the Allied armies. The German defeat, which was brought about by an army numerically inferior on the whole front was due, primarily, to the superior strategy of Joffre, who so quickly atoned for the failure of the initial strategic plan.

Causes of initial failure of Allies.

This initial failure was due to several causes, which may be divided into failures of strategy and failures of tactics. Pre-eminent among the former was the hopeless under-rating of the German strength, both as to the number of corps and as to the fighting value of the so-called Reserve Corps, which were in reality very little inferior to the corps of the 1st line, and were used in the front line.

The failure of the 3rd and 4th armies in the Battles on the Semoise, freed the German 3rd army for use against Lanrezac, and it is probable that the latter would have been compelled to fall back even if he had not been defeated by Bulow at Charleroi.

The Belgian strategic concentration, based on Antwerp, was unsound: that army was at the mercy of the Germans from the opening of the campaign. It was also a dangerous lure for the French, and a less skilful strategist might well have sent a large force to operate on the Belgian right, and so played into the hands of his opponent.

The Allied left wing, opposed to the pick of the German army, was composed of armies of three nationalities operating from divergent bases. This was a source of weakness and made co-operation extremely difficult.

The French strategic plan, in spite of its defects and failures, might well have succeeded, but for the tactical failures in all the frontier battles. Had Wurtemburg and the Crown Prince been decisively defeated on the Semoise and forced back through Luxemburg, Hausen would have hesitated to have attacked between Namur and Givet, and would probably have acted against the French 4th Army's left through the Ardennes. Lanrezac had then an excellent opportunity of isolating and defeating the German right wing.

The tactical failures on the Semoise and Sambre were due, firstly, to indifferent generalship which was mainly shown in lack of mutual support; and secondly, to failures due to defects in peace training and in the use of armament. Artillery preparation was not supported by aircraft co-operation, nor did it systematically support the infantry attack. Lack of howitzers prevented plunging fire being brought to bear on strongly defended localities: infantry did not consolidate captured positions and were averse from using the spade in the attack and defence. Machine guns were not sufficiently numerous or skilfully used, and the system of ammunition supply was inferior to their opponents. The German armies generally speaking, showed more elasticity of movement.

Causes of German failure.

The first setback to the German strategic plan was the failure to crush the French 5th army in the Sambre—Meuse salient. This was due to lack of co-operation between Bulow and Hausen. which

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resulted in the premature attack of the former. Thus it happened that the striking tactical failures of the French on the Sambre actually led to their escape from envelopment on their right rear.

The second setback was the failure to envelop and destroy the British army at Mons. This was due to Kluck's failure to discover its position, which resulted in the dispersal of his corps which were looking for the British between the Sambre and the Scheldt.

Another opportunity to destroy the British left at Le Cateau was due to the same cause, and to the failure of the German infantry in allowing the British to get away at dusk.

The operations of the three German armies on the right should have been placed under one control so that their movements might be directed and co-ordinated.

This failure in co-ordination by German G.H.Q. continued throughout the advance to the Marne: this march was carried out too rapidly, with the result that the principles of mass and security were neglected. Moreover, alarm at the situation in East Prussia made G.H.Q. denude the right wing armies of two much needed corps. This was a fatal violation of the principle of concentration of force at the decisive point.

These corps, which did not arrive in the east until after the crisis there was over, should have been taken from the Lorraine army or, better still, should not have been sent at all. Had they not been taken, they would have filled the gap between Bulow and Kluck on the Marne, with the probable result that Manoury would have been defeated and driven into Paris.

The perilous position in which Kluck was placed on September 5th was due to his belief that he had in front of him beaten and demoralised armies. Nor had he believed that the advanced troops of the 6th Army he had driven back from the Somme were more than isolated detachments.

Had he been allowed to continue his march over the Marne for another 24 hours, he could hardly have saved himself from complete envelopment. After the Marne battle his army was placed under the control of Bulow, while Hausen was superseded and his (3rd) army reconstituted after the battle of Fere-Champenoise.

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A HISTORY OF ARTILLERY.

PART II.

THE FOUNDING AND EARLY HISTORY OF THE ROYAL REGIMENT, 1716-1756.

By Ralph Flenley.
(University of Manitoba, Winnipeg, Canada).

(Continued from page 242.)

THE peace of 1713 not merely left England with new possessions abroad requiring permanent garrisons of gunners as of infantrymen, it left her also a considerable body of trained gunners, both officers and men. For the moment it looked as though having come successfully through a long series of wars with no artillery establishment more permanent than those already described, further change would be postponed indefinitely. Economy and the reduction of the army were of course the words of the day, and the artillery was cut down, companies disbanded, officers put on half pay, with no thought of the lessons the late war had taught. It might indeed have taken a further long period to demonstrate the inefficiency of a system—or lack of it—which left the preparation for war of so indispensable an arm to the last moment, when the country was already at war. Fortunately, within two years of the peace an occasion arose which showed the danger of relying on the isolated groups of gunners in garrisons for a field train in a sudden emergency. On the opening of the Jacobite rebellion in 1715 a train of thirty guns and howitzers was ordered on the 4th of August. This was increased in November to two companies and placed under Borgard as Colonel. It did not reach Scotland until well on in January of next year. Arrived there, Borgard was ordered, he tells us, to leave his guns and march his personnel to Stirling to take over a field train brought from Edinburgh, which last was "in such confusion as cannot be expressed," the field train from England being returned in May without having been used at all. From the nature of the operations we should not expect artillery to play a large part in the suppression of the rebellion, but the difficulties and delays in raising a small field train when the country was full of experienced gunners and there was no lack of guns, were out of all proportion. The lesson was however of value, and Marlborough was now, again, at the head of the Ordnance to apply it. It matters little that the case for a regimental organisation was on paper based on the necessity for the provision of the garrisons abroad as on the economy in money which would be ensured thereby. The real argument was the experience of the last twenty years of war and the recent warning of the Jacobite rebellion, which last might of course be repeated.

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It was therefore proposed to create a permanent establishment of four companies of gunners "with proper officers," and a small number of engineers. This was modified in the first instance and the Regiment as actually created by warrant of 26th May, 1716, was of two companies only, based on the train raised the year before. Each company was to consist of a captain, two lieutenants, two lieutenant-fireworkers, three sergeants, three corporals, three bombardiers, thirty gunners and fifty matrosses. This was amended four years later when the officers of a company were to be a captain, a captain-lieutenant—a new rank—a first and two second lieutenants and four fireworkers, whilst the other personnel of the company was increased by nine bombardiers. Five of the gunners and matrosses respectively were of cadet rank and two drummers were substituted for matrosses. As yet no colonel or staff were provided, though there were colonels commanding artillery in the earlier wars and a colonel was given in the "establishment" of 1718. Colonel Borgard commanded the artillery sent to Spain the next year, and three years later became the first Colonel of the Regiment.

Whilst it is impossible to linger over the character or achievements of any one individual in a record of this sort, we cannot omit a word or two about so interesting a figure as Borgard's, and one is the more tempted to this because he has left a brief but remarkably interesting account of his career.[1] He was not an Englishman but a Dane by birth, serving his military apprenticeship with the Danish forces. In 1676 when seventeen years old, to quote his autobiography, "several young men that were well recommended were taken out of the foot regiments to be made gunners of the artillery, of which I was one of the number and served as such in the great battle of Lund." From that date to his death in 1751 he followed the fortunes of gunnery in peace and war. At first it was in war. Made a Fireworker in 1679 he was sent to Berlin to study Prussian artillery methods, fought with German forces in Austria and Hungary, in Poland under its king, in 1689 joined the Prussian army and fought against the French on the Rhine, commanding two mortars at the siege of Bonn. Thence he came to the British army in Flanders in time for the failure at Steenkirk. He shared in the defeat of Landen and in the successful siege of Namur "which place," he tells us, "I bombarded with twelve great mortars and did throw about 4,000 bombs into the town, Cohorn's work and Terra Nova before the siege was over." In the English service he remained during the years of peace (1697-1702), on the outbreak of war in the latter year going first in the "bomb ships" to Spain and then as volunteer to Flanders, being recalled to command the artillery going to Portugal in 1703. He shared in the fighting there and in Spain being wounded several times and made lieutenant colonel ere in 1708 he was sent in charge of the artillery on the successful expedition against Minorca. Returning to Spain he was again wounded and taken prisoner at the battle of Villa Viciosa in 1710, allowed to return to England on parole and was exchanged. His reputation in England as a gunner of knowledge and experience stood deservedly high after the peace.

[1] It is printed in Duncan's *History*, Vol. i.

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He commanded the artillery for Scotland in 1715 and that for the Spanish expedition four years later. He tells us how in 1716 "I was ordered by the Board of Ordnance to lay before them tables and draughts of all natures of brass and iron cannon, mortars, etc., which was done accordingly and approved of." They could hardly have found a more fitting man than Borgard, with his record of over a score of sieges and nearly a score of battles, to be the first Colonel of the Regiment. To his practical experience he added a considerable knowledge of and interest in the gunnery of his time. Beyond the statement just quoted, there is the evidence of the many drawings of cannon, tables of guns and mortars with their charges, now to be found in the Library of the Royal Artillery Institution. And beyond this and probably most important of all was the energy he displayed in the organisation of the Regiment, the training of its members, and the supervision of its ordnance. Nor were his subordinates much less experienced in war.[1] In fact probably the major part of the members of the new companies had seen service in Flanders or elsewhere.

It has been said that the newly-formed regiment was fortunate in having a long period of comparative peace after its formation in which to grow before being subjected on any large scale to the test of war. This point is debateable. The growth however is unquestionable and may conveniently be followed here over the whole period under review. In 1727, five years after the appointment of Colonel Borgard, an additional two companies were added and what was as important, a regimental staff was created. Colonel Borgard became the first Colonel Commandant, with a Lieutenant-Colonel, a Major, an Adjutant, a Quarter Master and—fitting reminder of the close connection with the Engineers—a Bridge Master. The Royal Regiment was fairly launched. Of these four companies two were stationed at Woolwich, one at Gibraltar and one at Port Mahon in Minorca. In addition there were the detachments of gunners, considered as belonging to the regiment, in Newfoundland, Nova Scotia and on board the "bombships," and also, as yet outside the regiment, small groups of gunners under their master gunners scattered about in the various garrisons of the kingdom, some "remaining of the old establishment" in process of being absorbed or replaced as it was considered necessary. For thirteen years, peace years it need hardly be said, no change was made in the establishment: the nation was waxing fat under the Walpole regime. In 1739 however came war, first with Spain and then, as always in the eighteenth century, with France. At once the regiment began to grow. A company was added in 1740 and the strength of the home companies was raised to one hundred and fifty, those of Gibraltar and Port Mahon to one hundred. A further company was raised this

[1] The first lieutenant colonel was Jonas Watson, appointed to that position in 1727. We first hear of him as a Captain in Flanders, where he fought through the war. He ended his career and his life in 1740 when commanding the Artillery on the Cartagena Expedition at the age of 78! Being asked to send in the name of the best artillery officer he knew to command the artillery on this expedition he is said to have replied "I have the honour to report that the best artillery officer I know is your most obedient humble servant Jonas Watson, Lieut.-Col."

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year and put under Colonel Jonas Watson for the ill-fated Cartagena expedition.

Next year the three companies in England were divided into four and next year again these four, with the remnants of the company now returned from the West Indies, were again divided into six companies making with the Mediterranean companies eight in all, though the establishment of each company had dropped to one hundred and seven all ranks. By this time a chaplain, a surgeon and a surgeon's mate had been added to the regimental staff. The year 1744 saw an additional two companies created, one joining the three already in Flanders. The next year witnessed a further development in the creation of a company of Gentlemen Cadets, and also one of the Woolwich companies was sent to garrison the newly captured Louisburg. Three more companies were added in 1746, i.e. there were now thirteen in all with the cadet company in addition, two in the Mediterranean, two in North America as one had been sent to Newfoundland some years earlier, one was left in Scotland after the '45 rebellion, one was sent to the East Indies this year, five were in Flanders and two in England exclusive of the cadets. This, which gave a strength of 1,454 was the maximum for some years. In 1748 came the peace of Aix La Chapelle, a truce like the peace of Ryswick half a century earlier. Three companies were reduced with no change in distribution save that as Louisburg was returned to France by the terms of peace, the company there was sent to Nova Scotia. The truce-like nature of the "peace" is illustrated well enough by the fact that within six years the regiment was sending detachments to India and North America to help in the fighting against the French there. In 1755, nominally a peace year, six more companies were raised, four of them for the East India service. One of these being almost to a man lost at sea, a fresh company was raised and sent in its place. Further, a small detachment was sent to Ireland, the nucleus of the "Artillery Company in Ireland" as it became the next year and the "*Regiment of Royal Irish Artillery*" in 1760. Before the most decisive of all the wars with France actually broke out in 1756 the regiment was still further increased by two companies to eighteen and the cadet company. At that for the moment we can stop: a tenfold growth in forty years and these largely years of peace augured well for at any rate the future size of the Royal Regiment.

Numbers alone however may give a very partial and incomplete idea of the growth and virility of a regiment. We must look through very briefly at its organisation, its training and above all at its work as occasion offered during this period in order to judge of the real growth of the corps. So far as organisation went the company remained the unit. In a sense whether termed company or as later in the century, brigade, or as in our own day battery, the unit has always been the same. By the end of this period the time was almost ripe for the union of the companies in higher organisations, at first battalions. But for the moment the whole nineteen companies were under the staff already mentioned, with Colonel Belford at the head on the death of Colonel Borgard in 1751. The position of the regiment and its members relative to the rest of the army was to

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some extent established during this period, as for example in the matter of the commissions of its officers. The artillery being the child of the Board of Ordnance the commissions of its officers under the rank of field officer were signed by the Master General and not, for a time, by the King. This is no place to discuss the pros and cons of the system of dual control over the artillery, profoundly as the history of the regiment has been affected thereby. It must suffice to note that when the question was raised as to the rights of artillery officers to sit on Courts Martial in Minorca in 1724, decision was given that they should sit on artillery cases with other officers of the army in accordance with the dates of their commissions. The question of status was raised again in 1744 when the Board of Ordnance argued the case of the artillery officers, and again five years later. It was finally settled in 1751 when by royal order the rank of all artillery officers was declared to be "the same as that of other officers of his army of the same rank," and provision was made for the signing of all future commissions in the Royal Artillery by the King, with counter signature by the Master General. It was in this period that a privilege was recognised, not seriously to be contested afterwards, that of the position of the artillery on parade. On the question being raised in 1756 it was definitely laid down by the Commander in Chief of the army, the Duke of Cumberland, that "the artillery take the right of all foot on all parades, and likewise of dragoons when dismounted." The privilege was presumably based on the practise of placing the guns on the right of the battalion when in action. Another custom of this time which, unlike the last has not survived the changes of modern warfare, was that by which in the field the flag of the army was carried on what was known as the "flag gun," most commonly at this time a heavy six pounder.

From the foundation of the Regiment its home has been at Woolwich. From what has been said of the earlier associations of artillery with the town, we hardly need the picturesque story of the way in which Woolwich became the home of gun-making though the explosion of 1716 probably helped the move in that direction.[1] The old rabbit warren at Woolwich was at that date a suitable enough spot for the making of guns. And it was natural enough that the regiment should plant itself or be planted alongside its guns, made and in the making. We may illustrate the close connection between the two by an extract from Borgard's diary, in which he tells how he "laid before the Board the ill state of the laboratory which the Board ordered me to put in some better order, and to be at as little expense as possible, which I did accordingly." As time went on and the regiment increased in size there came inevitably more specialisation of work and a less close connection between the future Arsenal and the regiment. The number of companies to be housed at Woolwich rose to six at one time, one of them requiring to be accommodated at Greenwich. The then scattered hamlet of Woolwich had already acquired the stamp it has retained ever since. From the extracts from the Order Books printed by Duncan in his History,[2] we can get a fair idea of the life in the barracks in the Warren at

[1] Cleveland *Notes*, 188-90.
[2] Vol. i., p.140 seq.

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this time, or perhaps more exactly of that part of the life of the day which called for regulation by special orders. Bearing in mind that these orders were issued at a time when discipline and indeed organisation in the army in general were neither as effective nor as complete as they are to-day, and that the new regiment had no body of regimental experience and was only beginning to build up a Regimental Spirit, the orders are pretty much what we should expect them to be.

Not a few of these orders concern the dress and equipment of the regiment. There was indeed uniform as there were gunners before the regiment existed. For the dress of the gunner of the latter part of the seventeenth century, as for that of the next two centuries, the reader must be referred to the plates in Macdonald's book on the subject. But something of the dress in the early years of the regiment may be said here. The first plain and satisfactory account we have is of nearly the middle of the century and we cannot do better than quote it. "The uniform dress of the officers was a plain blue coat, lined with scarlet, a large scarlet Argyle cuff, double breasted, and with yellow buttons to the bottom of the skirts; scarlet waistcoat and breeches, the waistcoat trimmed with a broad gold lace, and a gold laced hat. The sergeants' coats were trimmed, the lappels, cuffs and pockets with a broad single gold lace; the corporals' and bombardiers' with a narrow single gold lace; the gunners' and matrosses', plain blue coats; all the non-commissioned officers and men having scarlet half-lappels, scarlet cuffs and slashed sleeves with five buttons and blue waistcoats and breeches; the sergeants' hats trimmed wih a broad and the other non-commissioned officers' and mens' with a narrow gold lace. White spatterdashes were then worn. The regimental clothing was delivered to the non-commissioned officers and men once a year with the exception of the regimental coat which they only received every second year; receiving in the intermediate year a coarse blue surtout, which served for laboratory work, cooking, fatigue duties, etc. The arms of the officers were fusees without bayonets and not uniform. The sergeants, corporals and bombardiers were armed with halberds and long brass-hilted swords; the gunners carried field staves about two feet longer than a halberd, with two linstock cocks branching out at the head and a spear projecting between and beyond them—great attention was paid to keeping these very bright; a buff belt over the left shoulder, slinging a large powder horn, mounted with brass, over the right pocket; and the same long brass-hilted sword as worn by the non-commissioned officers. The matrosses had only common muskets and bayonets, with cartouche-boxes."[1]

The later years of this period brought modifications of this. In 1750 "the sergeants' coats were laced round the button holes with gold looping, the corporals, bombardiers and rank and file having yellow worsted looping in the same manner. The corporals and bombardiers had gold and worsted shoulder knots, the surtouts were laid aside and complete suits of clothing were issued yearly." A year before black spatterdashes had been added to the white, probably after the experiences of Flanders mud—though shortly before

[1] Cleveland *Notes* p. 228 and Duncan History, i. 140.

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every man had been required to have a pair of white stockings. "Proper wigs" for men "that do not wear their hair" were provided for in 1750; the wearing of bob wigs by officers when under arms was forbidden in 1754. In regard to equipment the gunner lost his field stave in 1748, along with his powder horn, sling and sword, and the matross his musket, both ranks receiving instead carbines and bayonets. The corporals and bombardiers exchanged their halberds for carbines six years later. Knapsacks and haversacks were added during these years. There are frequent references to reviews during this period, notably in 1749 when for the first time the king reviewed his Royal Regiment of Artillery:—"every man to parade with his arms and accoutrements as clean as hands can make them; and in case any of their clothes want mending or buttons, the person so offending shall be severely punished. And the first man that is seen drunk, or the least in liquor, he shall be immediately brought to the halberds and there receive 300 lashes and afterwards be drummed out of the Regiment with a rope about his neck." The cadets, if they wished to see the fireworks which followed the inspection, were to parade at 5 a.m. and march, "taking white spatterdashes in their pockets to appear in." For the next review by the King however four years later the cadets occupied a more definite place, on the right of the companies, next to the three light six pounders which flanked the parade.

It must have been clear to the founders and early fathers of the regiment, if we may so term Borgard and his contemporaries, that whilst they themselves had learnt their art in the field, the provision of officers for a rapidly growing corps, and that corps one in which even at that time no small amount of scientific training was required, necessitated some scheme of training for future officers. Cadet gunners and cadet matrosses appear in the regiment for a few years after its formation. They served in the bombships under the lieutenant fire-workers. To judge from a report of 1739 their position and discipline was not very satisfactory, since out of sixteen supposed to be in the two Woolwich companies, nine have the remark, "I know not where he is" opposite their names, and a tenth was "a very idle fellow." Two years later the Royal Military Academy was founded. It has of course its own history. But its foundation was as important a step in the early history of the regiment as its later history has been for the whole life of the Regiment. Not that it attained at once the position it was later to hold. Its scope at first was wider. In addition to the cadets proper who might apparently be of any age from twelve upwards, the youthful academy provided as best it could for the general instruction in artillery work of the companies stationed at Woolwich, as well as for the general instruction of any "gentlemen attendants," sons of officers resident at Woolwich and the like, who cared to attend. The cadet company of the regiment was not founded until 1745 and contained first forty-eight cadets and then a varying number above that. Thus composed the early history of the Academy was rather that of a boys' school, its troubles and disciplinary problems as depicted in the extracts made by Duncan from the Orders of the period those of a school and school boys. Yet though some of the older empirical school of officers professed disbelief in it, there is no reason to doubt the assertion of this period

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that "the junior officers, who of late had been promoted from the cadet company, being of a different stamp and better educated, and being now the majority, entered with great zeal and military spirit into the newly adopted alterations and improvements." That the Board of Ordnance had high hopes and aims for the officers to be produced by the Academy we may gather from their statement of 1744. "The qualifications of artillery officers are not acquired by practice only but are the result of long study and application. They must be proficient in several sciences and masters of several arts, which is not required from other officers." We can leave it to history to say how far their estimate has been correct and their faith justified.

The peacefulness of these years has been remarked on. But they were only peaceful when compared with the years of hard and protracted war already gone and shortly to begin again. The peace distribution of the growing regiment we have seen. To it should perhaps be added what we should take for granted to-day, the establishment of the system of relief of the companies on garrison work abroad by companies from Woolwich. This seems to have come first in the year after the peace of Aix-la-Chapelle when the companies at Gibraltar and Port Mahon were relieved for the first time. Military and naval duty abroad were apt in these years of unsettled issues with France to shade off almost imperceptibly from peace to war. The course of events in America and India between 1748 and 1750, years of nominal peace, illustrates this well enough. And the naval history of the period is somewhat similar. With the history of the sea fighting in general we are not concerned but mention must be made of the share of the artillery on the "bombships." Both officers and men of the artillery under the Board of Ordnance had served on the King's ships for generations before the regiment was founded, and the regiment took over the system. One writer sees in the appointment of a Chief Bombardier in 1686 the "first permanent establishment of the bomb ship."[1] It was in the wars that followed the Revolution of 1688 that the bombship or "bomb" became prominent. Fulfilling for their day and generation much the same kind of function as the monitors of the late war, they were comparatively small and light of draught carrying one or two brass mortars usually of 13 inch calibre; later we find a 10 inch howitzer added. They assisted in coastal raids and attacks, on the French coast, or in the Mediterranean, or as in 1727 in the Baltic. They were also sent further afield, to the West Indies or even North America, as against Louisburg in 1745. In general they were employed in pairs but sometimes three or even more were used. When this was the case a Firemaster would be appointed for all the "bombs." Normally a fireworker and two bombardiers were attached to each mortar, supplied, after 1716, from the companies stationed at Woolwich. The mortar "with thirty pounds of powder will throw a shell of 240 pounds four thousand yards," was the estimate of the time.[2] The service seems to have been a popular one in the regiment, probably in part from the independence

[1] Murdoch in *Mins. of Proc., R.A.I.*, xxi, 1894 p. 30.

[2] Cleveland Notes, pp. 215-16, 1738.

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of command it brought. And the regularity with which the vessels were detailed to accompany expeditions suggests that the mortars rendered effective service. We are specifically told that they did so against Havre and Dieppe in 1694. Borgard as a major commanded five of these vessels sent as part of an expedition against Cadiz and tells us how he successfully bombarded several places, though the expedition failed in its object. The land trains of artillery at this time had mortars with fireworkers and bombardiers as well as the bombships. And just as the bombardier became merged in the ranks of the non-commissioned officers, so the fireworker found a place in it below the second lieutenant. He had been paid five shillings a day in King William's day but his pay fell first to four and then to three shillings and he had become a sort of third lieutenant by 1740 when the number allowed to each company was raised from two to four.[1] After the peace of 1748 the number was again reduced to two. A list of a few years later gives us the name of Forbes McBean, to be one of the most distinguished gunners of his day, whilst in the same list as captains appear Desaguliers and Pattison. Before leaving the subject of the fireworkers and bombships an event of 1744 ought to be recorded. The artillery serving on board the bombships in the Mediterranean was asked for by the king of Sardinia "to take charge of the most important posts and batteries on his frontier, from a persuasion as may be justly presumed, that they were more to be depended on than his own artillerists." The detachment, of one captain, four lieutenant fireworkers and twenty-four bombardiers, after performing their task "perfectly to the satisfaction of his Sardinian Majesty" were taken prisoner in an assault by the French and Spanish.

Whilst Flanders continued to be the main field of operations during this period, the earliest offensive and defensive actions in which the members of the newly-formed regiment were engaged took place in Spain. In 1719 by way of reprisal for a Spanish attempt to give support to the Jacobites, a British force of 4,000 men under Lord Cobham was sent to take the revenge usual at this period, by attacking the Spanish coast. Colonel Borgard commanded the artillery which consisted of a small "company" with fourteen guns (four 24, four 9 and six 1½ pounders), forty-six mortars (two 10 and two 8 inch, thirty cohorn and twelve royal), and two petards, with round shot and a little grape for the guns, and "carcasses" and shells for the mortars. There were also two bomb vessels with 13 inch mortars. Vigo the place selected was successfully "bombarded with forty-six great and small mortars of my own projection," says Borgard. The town and citadel were taken without much delay and the expedition returned safely. The enterprise served no useful purpose and only merits mention here as the first offensive operation of the regiment. Eight years later the antagonism of England and Spain again flamed into war, the Spaniards having the avowed object of recovering Gibraltar. They besieged it for four months, its second siege. Fortunately there had been time

[1] The second lieutenant was paid 4s. a day and the first lieutenant 5s. a day at this time.

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under the obvious danger of such a siege to increase the garrison there, including the artillery. The English command of the sea enabled them to use bomb ships with great effect against the Spanish entrenchments. They were vigorously supported from within the fortress where the two hundred artillery men who took part in the defence were commanded by Colonel Jonas Watson. Aided also by the course of events elsewhere the besieged had the satisfaction of seeing the Spaniards abandon the siege: the gunners could, if they wished, take it as a good omen for more strenuous days in store at Gibraltar and elsewhere.

These were not long in coming. An alarm in the same year as the siege of Gibraltar indeed had led to the organisation of a field train for Flanders, but the storm cloud did not burst then. In 1739 however the country went to war with Spain and three years later with France. Before the actual declaration of war with the latter country, English troops had crossed to Holland as auxiliaries to Maria Theresa, the main French army being far to the east in Germany. Three companies of artillery with thirty three-pounders accompanied the British force. Nothing was done in the way of fighting in the year 1742. Next year saw the British force marching south-east from Flanders, joining the Hanoverian and Austrian forces on the Main near its junction with the Rhine. There in June was fought the battle of Dettingen. The French artillery, carefully placed on the west and higher bank of the river Main to catch the allied force in flank as it marched north along the one high road available on the east side up to Hanau, had a larger share in the operations of the day than the four-and-twenty British three-pounders, most of which, the army being on the march and not expecting to fight, had been left in the rear. They were hurriedly sent for when the galling French fire began to take effect, and once arrived, seem to have replied effectively to the French fire across the river. Of their share in the confused battle which followed there is practically nothing to say. The small and crowded battlefield, much of it so marshy that the infantry could scarcely advance across it, did not give much scope for artillery work even with three-pounders. They were more effective against the Frenchmen fleeing in disorder across the river they had crossed to attack in the early morning. This battle ended the campaign so far as the British were concerned and the next year saw no general action in Flanders where the conflict had gravitated according to wont. An additional company, one of two new ones raised, was sent to Flanders this year making four there for the campaign of 1745, with an addition to the 3-pounders of ten heavy 6-pounders, six 1½-pounders and four 8-inch howitzers, the 6-pounders being drawn by seven horses, the 3-pounders by four and the howitzers by five.

This year as everyone knows was that of Fontenoy and the "forty-five." Of the former it would be foolish and perhaps impertinent to try and recount in the short space available what has been so finely described by the historian of the British Army.[1] Fontenoy was too above all the day of the British infantry. Yet the share of

[1] Fortescue, ii, pp. 102-121.

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the artillery in the battle was far from negligible, in particular on the French side. They were on the defensive covering the siege of Tournai a little lower down the Scheldt, and when the allies under Cumberland faced them they had occupied a position naturally extremely strong running east from the Scheldt along a ridge through Fontenoy whence it turned and ran northwards to a small wood. Art had strengthened the position further. Double entrenchments faced the British on its eastern portion, redoubts with guns flanked the extreme left, Fontenoy with more guns held the centre, Antoin with more the right and, probably recollecting the services rendered by the batteries firing across the Main at Dettingen, a battery was planted on the farther bank of the Scheldt to enfilade troops attacking the extreme right. The attack there indeed was not pushed; the brunt of the fighting fell on the British on the other wing. Without discussing the doubtful wisdom of Cumberland's attack or the causes of its failure we may note how important a part in that failure was played by the French guns with their cross fire from Fontenoy on the right and the advanced redoubt on the left against the British advancing between the two. The share of the British artillery was less notable. It was indeed far less than it would have been had not the guns been rendered to a considerable extent immobile by the disappearance ere the fight had well begun of the civilian drivers of the teams with their horses, fruit of the miserable system which was nevertheless to obtain for another half century, by which the horsing of the guns still remained a contracted civilian affair. Yet a fair share in the fighting the regiment may claim to have had. In the early morning whilst the British infantry were deploying within the range of the French guns which were making the most of their opportunity, seven 6-pounders, heavy field guns as yet, were brought up to answer them and did so though out-numbered and less well placed. Later on the battalions, pulling along by hand the two 3-pounders allotted to each, advanced with the steady courage which made the attack "an example of the prowess of British infantry . . . almost without a parallel in its history." Not at our three thousand or at three hundred but at thirty yards the 3-pounders, intermingling grape with musket balls, helped to crush and break down the French front and second lines and beyond. And with what remained of the infantry after the desperate fighting the little guns came back, not without their own casualties. It was the first really heavy and close fighting in which the regiment had engaged.

In the autumn of that same year the threat of invasion brought the return to England of all the artillery in Flanders along with most of the infantry, though they left a detachment of one officer and fifty men sent out in August to strengthen the garrison at Ostend, the British base, and captured on the fall of that place within a fortnight of their arrival there. The regiment only shared in the closing scenes of the '45 rebellion for the garrisons of Stirling and Edinburgh which were left like islands above the Highland flood on whose crest Charles Stuart was borne as far as Derby, were not yet supplied by the regiment. At Prestonpans, the first serious engagement, the six guns of Cope were served or not served by seamen being

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almost at once overrun by the Highlanders emerging from the mist. At Falkirk we might have expected guns to take more part since the rebels had from the French both cannon set up in regular siege fashion against Stirling and also a number of field pieces, whilst the English commander Hawley had with considerable trouble contrived to man the artillery with which he had been supplied. The gunners he was supposed to draw from Berwick and Edinburgh were civilian "place men" and quite untrained, the garrisons probably keeping what trained men they had for their own defence in the general alarm. Hawley's heavy artillery was still at Newcastle for lack of horses. Some guns however he had contrived to take with his somewhat "scratch" force, but they played no part in the battle being in fact stuck in the marshy ground of part of the battlefield. The fear of the rebel advance on London in the days before Falkirk had indeed caused two companies of the regiment to be sent to join the force collected at Finchley for the defence of the capital, but the alarm had been but momentary. In the finale at Culloden one company shared, with ten light "battalion" guns which had accompanied Cumberland's force in the difficult march through the Highlands. In the battle the guns were placed in pairs between the six battalions of the front line and in addition to silencing the few Jacobite guns, had no little effect on the moral of the Highlanders, for it was the first occasion on which they had had to face even so light a cannonade as well served and well directed 3-pounder grape. Yet there is nothing in the history of the '45 rebellion for us to linger over. If the last encounter had shown the quality of the regular gunner, the earlier field operations had shown the complete ineffectiveness of the old system whereby the so-called "gunners" who tended to fill the garrisons in peace time were relied on to take the field in time of war.

The remaining years of the war in Flanders to the peace of 1748 offer no outstanding events for us. The allies were far outnumbered by the French in guns as in men. Yet the years were of value to the rapidly growing regiment in view of the inevitable struggle to come. Two companies had been returned to Flanders in 1746 with little more armament than the 3-pounder guns for the battalions and there was the usual difficulty and delay in horsing them. For a time the companies were almost entirely split up into detachments of two guns each under a lieutenant serving with the battalions, but this was soon discontinued as a permanent organisation though the battalion guns still continued to be a feature of the battle line. In the only general engagement of that year, that of Roncoux close to Liège, the allies were outnumbered by forty thousand men and proportionately so in artillery. They were fortunate to escape with casualties about equal to those of the French and the loss of eight guns. The disproportion in men was little better in the next year but something was done to remedy the lack of sufficient artillery. A further three companies of the regiment were sent to Flanders making five companies for fourteen battalions of infantry and four regiments of cavalry. Colonel Belford, who had commanded the artillery at Culloden and who was esteemed a worthy successor to Colonel Borgard, was in command and displayed the

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utmost vigour in the disciplining and training of the companies both in artillery work and in small arm exercise before the campaign opened. The number and weight of ordnance was also much increased. To the 3-pounders were added six heavy 12-pounders, six heavy 9-pounders, twelve light 6-pounders and two 8-inch howitzers. The 1½-pounders had gone, the current in fact running the other way. For though the 3-pounder may be regarded as the field gun of the period, the despatch to Flanders in the last year of the war of a large number of light 6-pounders "for the battalions" marks a definite advance which only the peace prevented from being given a fair test. Increases in artillery alone could not make up for general disparity in numbers or the division of counsels which had always weakened the allied efforts against France in Flanders. The fighting ended where Marlborough's had begun, on the lower Meuse, with the battle of Lauffeld, a few miles south-west of Maestricht. The Allies, again in contrast with Marlborough, were on the defensive. The brunt of the French attack was borne by the British on the allied left, and was fiercest round the little village of Lauffeld. There in front and on the flanks of the village which was held by five battalions guns were posted and bore their part in the desperate fighting which raged in front, round, and finally after repeated attacks by superior numbers, in, behind and through the village. The gunners sustained, for their numbers, fairly heavy casualties in killed, wounded and missing ere the battle was over and an orderly retreat secured by the heroism of the British cavalry. For I think the first time the services of the Royal Regiment received special recognition for their share in that day's fighting. It was the last serious fight of the year and indeed of the war. The regiment supplied a detachment, almost a company, in July of this year for the defence of Bergen op Zoom whose fall marked the close of the campaign. That of the next year had barely begun ere it was closed by the peace negotiations, and needs no mention. The companies returned to Woolwich and the regiment was reduced, as we have seen, by three companies.

Leaving this school of war it remains to say something of the other enterprises in which the regiment engaged during these years. Not that the period saw, either in general or in the history of the regiment, any spectacular successes: it was the period of effort, not yet that of fruition. There were outside Europe at this time three theatres where we should expect to find that effort displayed, the West Indies, North America and India. The war which we have glanced at in Flanders began as a war with Spain, with trade disputes as the motive. It was natural enough that an expedition to the Spanish Main should have been undertaken. The unwisdom of it, the lack of preparation, the delays, the bad leadership, need not concern us in detail. With the nine thousand soldiers who sailed from England and America to take part in the expedition against Cartagena there went one company of artillery, of about the strength of a field battery on active service today, and a small company of miners. The train was commanded by Colonel Jonas Watson and included eight 24-pounders, ten 12-pounders, four 6-pounders, eight 3-pounders, two 8 and two 10-inch brass mortars, twenty Cohorn—

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about five inch—mortars, and two petards. Presumably it was not intended to rely solely on the one company of artillery for the whole service of the train. Nor could they as events proved. The enterprise was a record of incompetence, maladministration, disease, death and failure, and the artillery seems to have been neither better nor worse than the other troops. They were—inevitably—unskilled in operations of the sort required, chiefly siege operations to be undertaken on short notice. On the principal occasion on which artillery was employed, the reduction of the entrance forts of the harbour, for some reason seamen were used to work the guns. The bad relations existing between naval and army commanders did not help matters. The last effort against the fort in front of Cartagena itself showed no better use of the artillery by the attacking forces. Colonel Watson was killed in this last attack, after whose failure, and when sickness had taken a far heavier toll than battle, the expedition returned first to Jamaica and then, what was left of it after two further futile efforts on the islands, to England. Those of the company of artillery who survived could congratulate themselves that they had exchanged that death trap for the army in the eighteenth century, the West Indies, for the muddy plains of Flanders. They had seen the worst of the war.

This was the sole occasion on which the regiment fought on the west side of the Atlantic during the war proper, though, as we have seen, its companies found their way across to Newfoundland and to Louisburg after its capture in 1745. One company had embarked in 1746 with six battalions for an expedition against Quebec, but the force was diverted for one of the pin-pricking efforts on the French coast against Port L'Orient in Brittany, a diversion which followed the usual course of almost all similar expeditions, bringing no result save discredit on the heads of those responsible for it. A more ambitious project, that associated with the name of the ill-fated Braddock, gave the regiment its first lesson in the dangers and difficulties of fighting in the wilds of the North American continent, a lesson for which the more formal fighting in Flanders had been but poor preparation for artillery as for infantry. With the two line regiments which left with Braddock for Virginia went a detachment of fifty artillerymen with ten guns, four 12-pounders and six 6-pounders—lighter ones would have suited better. In Virginia recruits were added to the artillery as to the infantry, making the company up to about one hundred, and Captain Ord, specially brought from Newfoundland, was placed in command of them. The course of the expedition is well enough known. After having toiled for a month through the forests at the rate of about three miles a day, every yard of the road for the guns and baggage having to be cleared,[1] Braddock's two thousand odd men were attacked by a much smaller force of French Canadians and Indians who had however the supreme advantage of knowing the best methods of fighting in that wooded country and were unhampered by Flanders traditions and training. The guns, though served vigorously enough, were of little avail against " a foe scattered and

[1] Fortescue, *op. cit.*, ii, 280-81, for the march.

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hidden amongst the trees which surrounded the trail," from that shelter picking off man after man of Braddock's force, yet presenting no target for methodical musket fire, much less so for the clumsy 12 or 6-pounders. After three hours of ever-growing confusion and loss from this invisible yet all encircling enemy, retreat, which speedily became a rout, was ordered, and the guns, like the wounded and dying, were left on the field, Braddock himself leaving it mortally wounded. It was another hard lesson for the regiment.

Yet one more early adventure deserves to be chronicled, in part at least as unhappy as any already mentioned. British guns had echoed on and off the coast of India for a century before the regiment took any part in the history of British expansion there. And as the East India Company during its long rule there had its own artillery as well as infantry—Bombay had one hundred cannon for its defence by 1674—it was another century before, with the Mutiny, the regimental history came to include what has always been a school for artillerymen. The apprenticeship of the regiment in that school was of the most modest description though it was a share in what was, in the opinion of Mr. Fortescue, "the event which finally decided the fate of India." A detachment of about eighty of the Royal Artillery under Captain-Lieutenant Hislop accompanied the squadron under Admiral Watson whose appearance off the coast, coupled as it was in time with the recall to France of Dupleix, marked the beginning of the end of the struggle between France and England there. Though nominal peace was signed between the rivals in the beginning of the next year, the struggle hardly ceased. Early in that year four additional companies were raised specifically for service in the East Indies. One whole company save three men was lost at sea off the coast of South Africa but a new one was raised in its place and despatched to India, the last of the old "companies" to go there. Their work there however belongs rather to the period of the Seven Year's War.

The end of the years of nominal peace in 1756 makes a convenient halting place. The regiment was forty years old. It had grown from two companies to eighteen; its first colonel had died in 1751. In Flanders, in the Indies East and West, in the Mediterranean, in North America, the regiment had had a generation of schooling, like all schooling both bitter and sweet. Its growth in numbers had come from a steadily increasing appreciation of the value of artillery. The 6-pounder had, for European fighting, displaced the 3-pounder as the "field" gun. But it had still a long way to go before mobility became a fact rather than a word. The driver was still unregimented; a company had as yet no specific number or nature of guns, heavy or light, "trains" of all sorts and sizes of ordnance were made up as occasion demanded on no system that we can observe, there was as yet no unit between the company and the regiment. Yet a camp held at Byfleet in this last year of peace 1755 does show promise of advance. For this camp the "train" organised was the largest that had ever left Woolwich in peace or war. It consisted of five companies with all the headquarters staff and both the Master-General and the Lieutenant-General of Ordnance attended the camp. The guns included eleven 24-

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pounders with five horses apiece, fourteen 12-pounders with three, twenty 6-pounders with two, six 5½-inch howitzers with two horses likewise, all of these "brass, on travelling carriages with ammunition boxes and elevating screws," ammunition wagons, carts, "tumbrils," pontoons, spare carriages, baggage wagons—the Master-General with as many as all six companies—and the like. They took with them about 4.000 rounds of ammunition, most of it "round shot fixed to wooden bottoms" but with some empty shell for the howitzers. From what we know of Colonel Belford's attention to drill and discipline in Flanders the camp would hardly be an idle one though we know nothing of its work. One interesting Order has survived however by which the guns were divided into "brigades," the 24-pounders of four and three guns, the 12-pounders of five and four guns, the 6-pounders of five, the 3-pounders of six, the howitzers of three. In peace, if not yet regularly and permanently in war, the "brigade," the modern battery, had arrived. There for the moment the Royal Regiment can be left, training against the harder days to come.

(To be continued.)

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BETTING AND BRACKETS.

(An Article without an X.)

BY CAPT. D. R. D. FISHER, D.S.O., R.F.A.

(Continued from page 89, May 1920).

PART II.

IN Part I of this article we ended up by examining the chances of a true Short Bracket, verified and unverified; that is, a bracket in which the two elevations differ by an amount corresponding to twice the 50% zone of the gun. Our conclusion was that if the intermediate elevation was selected, the chance that the target lay somewhere inside the 50% zone of the gun at that elevation was ·39 with an unverified bracket, rising to ·52 when the bracket was verified. We have now to examine the 100 yard bracket, and we will do so from the point of view of the 18-pounder, selecting various ranges at which the 50% zone of the gun is equal to some convenient fraction of 100 yards.

As all these problems are solved in the same way as that of the true Short Bracket, it will not be necessary to reproduce the working in detail; we will content ourselves with giving the various diagrams and the conclusions drawn from them. It may however be as well to recapitulate briefly the successive steps in the solution, so that the diagrams may be appreciated without further reference to Part I. In the case of an unverified bracket, there are three distinct steps:—

(a) The 'Plus' and 'Minus' curves are arranged in appropriate relation to each other, i.e. so that their centres are, in terms of the 50% zone, a distance apart corresponding to the bracket in question.

(b) The 'Bracket' curve is compiled by selecting a number of points between the near end of the 100% zone of the gun at the lower elevation, and the far end of the 100% zone at the higher elevation, and multiplying together the individual 'plus' and 'minus' chances at each of these points in turn.

(c) The centre of the curve thus produced corresponds to the centre of the zone of the gun at the intermediate elevation, and the chance of the target lying inside the 50% zone at that elevation is expressed by:—

$$\frac{\text{the area subtended by this 50\% zone}}{\text{the total area of the curve}}$$

or, as all these curves are symmetrical, by:—

$$\frac{\text{the area subtended by half this 50\% zone}}{\text{the area of half the curve}}$$

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We may therefore content ourselves with reproducing only half the combined curve in each case.

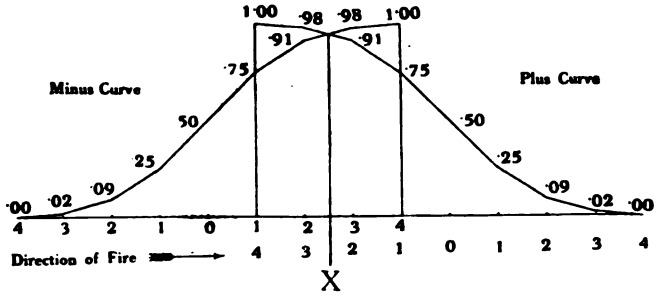
To find the odds when the bracket is verified there is a further step to take. Since a verified bracket is essentially two simple brackets taken together it may be treated as a 'double', which is done by squaring the chance (i.e. the perpendicular) at each point of the curve of the unverfied bracket. In this way another curve is compiled, from which the final answer is extracted by a similar comparison of areas. Since this curve also is by construction symmetrical only half of it is required, and we may save space by placing the left half of the unverified bracket curve and the right half of the verified one side by side in the same diagram.

Let us now proceed to examine various 100 yard brackets from the point of view of the 18-pdr. The most convenient cases to consider are those where the 100 yard bracket corresponds to 2½, 3, and 4 times the 50% zone, i.e. at ranges of 4300, 3300, and 2300 yards, where the Range Table 50% zones are 40, 33 and 25 yards respectively.

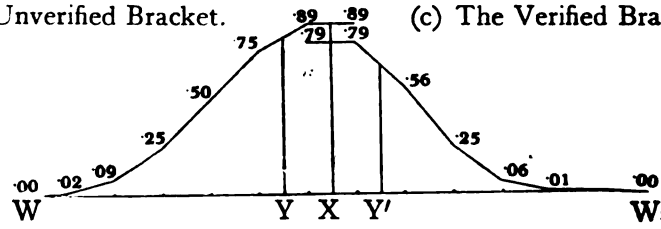
Case 1. 18 Pdr at 4300; 100 yard bracket equals 2½ times the 50% zone. (Fig. 9).

Fig. 9. 18 pdr. at 4300; 100 yd. Bracket with a 50% zone of 40 yds.

(a) The arrangement of the 'Plus' and 'Minus' Curves.



(b) The Unverified Bracket. (c) The Verified Bracket.



Chance (b) = $\frac{\text{Area YX}}{\text{Area WX}}$ = ·35. Chance (c) = $\frac{\text{Area XY}'}{\text{Area XW}'}$ = ·46.

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Fig. 9 (a) shows the arrangement of the 'Plus' and 'Minus' curves, their centres being 2½ times the 50% zone apart.

Fig. 9 (b) shows the 100 yard bracket curve (unverified) deduced from Fig 9 (a) as explained above; i.e. by multiplying together the individual 'plus' and 'minus' chances at various points in the combined zone.

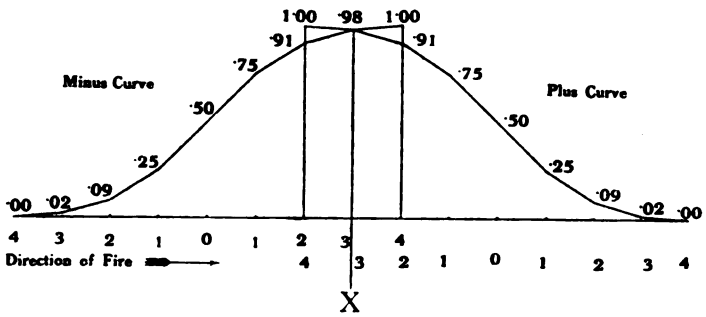
Fig. 9 (c) shows half the 100 yard bracket curve (verified) deduced from Fig. 9 (b) by squaring the perpendiculars.

When the appropriate areas are compared, it will be found that the chances of the target lying inside the 50% zone of the gun at the intermediate elevation are with an unverified bracket about ·35 and when the bracket is verified about ·46.

Case 2. 18 Pdr at 3300; 100 yard bracket equals 3 times the 50% zone. (Fig. 10).

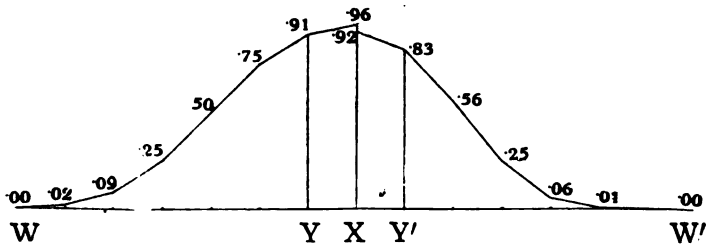
Fig. 10. 18 pdr. at 3300; 100 yd. Bracket with a 50% zone of 33 yds.

(a) The arrangement of the 'Plus' and 'Minus' Curves.



(b) The Unverified Bracket.

(c) The Verified Bracket.



Chance (b) = $\frac{\text{Area YX}}{\text{Area WX}}$ = ·31. Chance (c) = $\frac{\text{Area XY}'}{\text{Area XW}'}$ = ·40.

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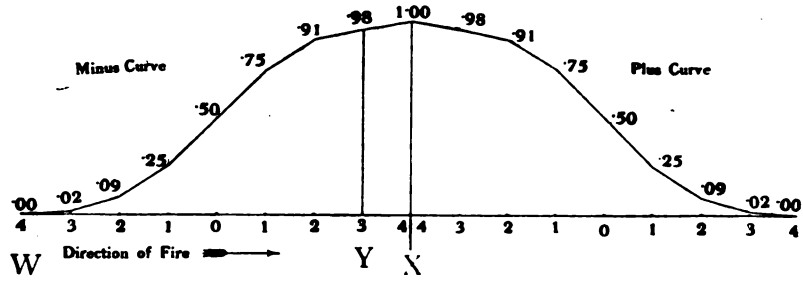
Fig 10 (a), (b) and (c) are exactly analagous to Fig. 9 (a), (b) and (c); no further explanation is necessary. The chances in this case work out to ·31 and ·40 for the unverified and verified brackets respectively.

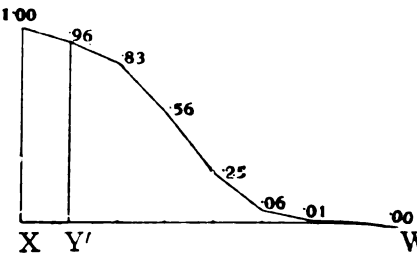
Case 3. 18 Pdr at 2300; 100 yard bracket equals 4 times the 50% zone. (Fig. 11).

Fig. 11. 18 pdr. at 2300; 100 yd. Bracket with a 50% zone of 25 yds.

(a) and (b).



(a) The arrangement of the 'Plus' and 'Minus' curves, which fit together to join the curve of the Unverified Bracket (b).



$$\text{Chance (b)} = \frac{\text{Area YX}}{\text{Area WX}} = \cdot 25.$$

$$\text{Chance (c)} = \frac{\text{Area XY'}}{\text{Area XW'}} = \cdot 31.$$

At first sight there may appear to be a radical difference between this and the preceding cases, but on closer inspection this will be seen to be a false alarm, due to the fact that there is no over-lap between the 'Plus' and 'Minus' curves. The 100 yard bracket in this case corresponds to 4 times the 50% zone, i.e. it is equal in length to the 100% zone, and the 'Plus' and 'Minus' curves in consequence butt up against each other and without more ado form the curve of the unverified 100 yard bracket, from which that of the verified bracket is deduced as before. The chances work out as ·25 and ·31 respectively.

Before attempting to draw any deductions from these results let us consider a special case which has little practical value in itself but which may perhaps help us in forming our conclusions: that of a very short bracket equal to the 50% zone of the gun.

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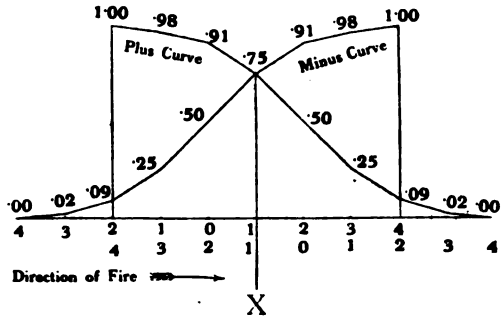
Case 4. Very short bracket equal to the 50% zone. (Fig. 12).

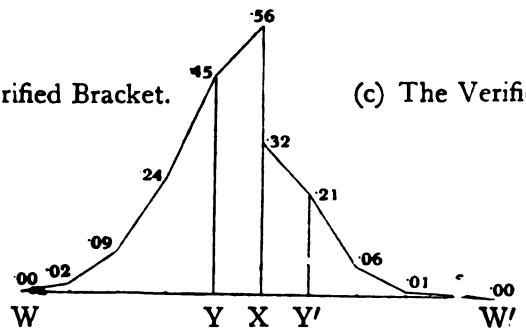
Fig. 12. Special Case; very short Bracket, equal to the 50% zone.

(a) The arrangement of the 'Plus' and 'Minus' Curves.



(b) The Unverified Bracket.

(c) The Verified Bracket.



$$\text{Chance (b)} = \frac{\text{Area YX}}{\text{Area WX}} = \cdot 47. \quad \text{Chance (c)} = \frac{\text{Area XY}'}{\text{Area XW}'} = \cdot 62.$$

Fig. 12 (a), (b) and (c) are exactly analagous to Fig. 9 (a), (b), and (c). The chances work out to ·47 and ·62 respectively.*

We have now examined a series of brackets, both verified and unverified, corresponding to various multiples of the 50% zone, and determined their respective chances. We have also (in Part I) determined the chance given by a 'plus-and-minus' at the same elevation, i.e. by what we may perhaps call an unverified 'zero' bracket.

Let us now set forth all these chances in a diagram (Fig. 13) in which we will include a chance that we have not as yet worked out, that of two pluses and minuses at the same elevation, i.e. a verified 'zero' bracket. We can only justify this somewhat arbitrary addition to our data by saying that it rounds off the results that we have already obtained, that it may be easily deduced from the combined

* NOTE—The only case where a similar state of affairs obtains with a 100 yard bracket is that of the 60 Pdr. Mark I at a range of 10,500 yards, where the Range Table 50% zone equals ninety odd yards.

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'Plus-and-Minus Curve' (Fig. 4, Part I) by anyone who cares to do so, and that the actual process of deduction will be necessarily included in a subsequent article on Groups, and may well be dispensed with here.

Let us now examine Fig. 13; there are three questions which by its aid we hope to be able to answer.

1. Whatever bracket we select, what do we gain by verifying it?

2. Is a bracket equal to twice the 50% zone the best that can be selected?

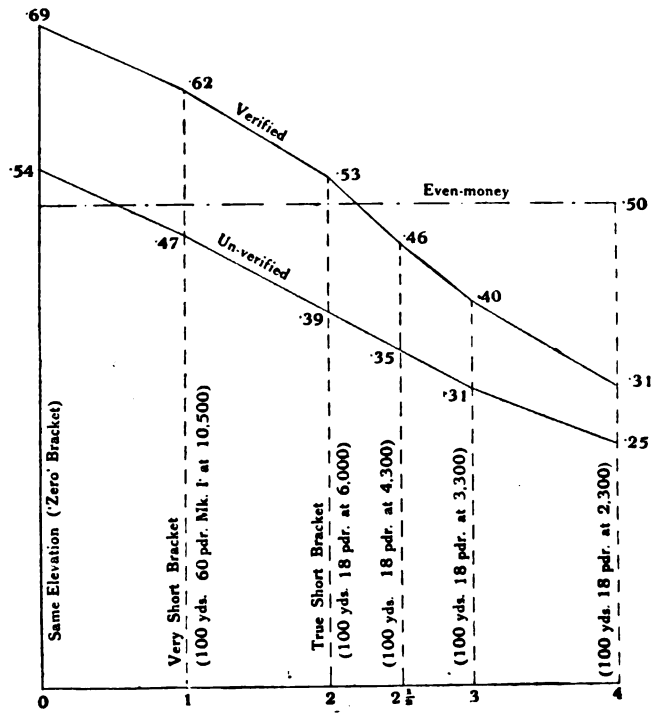
3. Are we justified in using a 100 yard bracket?

Let us consider them in this order.

1. What do we gain by verifying a bracket?

We can look at this from two aspects. Theoretically, it will be seen from Fig. 13 that verification of a bracket improves the chance (that the target lies somewhere inside the 50% zone of the gun at the intermediate elevation) by some 30%. Practically, verification is of course a safeguard against basing conclusions on an abnormal round. From both points of view therefore, it is important to verify any bracket from which it is hoped to deduce a reasonably close approximation to the true elevation to the target, i.e. any ordinary short bracket, 100 yards or otherwise.

Fig. 13. Diagram showing chances of various Brackets etc., both unverified and verified.



Base graduated to represent the Brackets in terms of the 50% zone.

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2. Is the 'true' short bracket (equal to twice the 50% zone) the best that can be selected? First let us ask, what are the alternatives?

(a) A larger bracket. We have investigated three such cases, i.e. brackets equal to 2½, 3 and 4 times the 50% zone, and Fig. 13 shows how the increase in the bracket decreases the corresponding chances that the target will be inside the 50% zone of the gun at the intermediate elevation. Theoretically therefore a larger bracket is unjustifiable, and its only practical advantage is that with a given number of rounds a greater extent of ground is covered, resulting in some cases in a certain saving of time to compensate for the loss in accuracy.

(b) A smaller bracket. It will be seen from Fig. 13 that a very small bracket, equal to the 50% zone, gives an improved chance as compared with the true short bracket; but against this theoretically improved chance (amounting to about 15%) must be set the practical difficulty of obtaining this very short bracket and especially of verifying it; we mean the strong liklihood that two elevations differing by so little will produce some kind of contradiction, e.g. three pluses and a minus instead of two and two. Such a result would stultify the object of the very short bracket, i.e. its relatively higher chance; because either further complicated ranging would have to be carried out in the endeavour to obtain this higher chance, or the contradiction would have to be accepted with its even-money chance, that is with the same chance as a verified true short bracket. A very small bracket is in fact an unhappy cross between a bracket and a group and like most hybrids has the virtues of neither and the defects of both.

We may therefore say of the true short bracket:—

(1). That it is small enough to give a relatively high (even-money) chance.

(ii). That it is large enough to be quite distinct from a group.

(iii). That if in attempting to verify it a contradiction is obtained at one or other of the elevations, that contradiction has the same value (an even-money chance) as the verification itself and results merely in the selection of the 'contradictory' instead of the intermediate elevation.

(iv.) It is a simple and convenient multiple of the Range Table 50 per cent zone.

These four points together constitute a very fair justification of the true short bracket for ordinary purposes of ranging.*

3. Are we justified in using a 100 yard bracket?

If our arguments in favour of the true short bracket are valid they should be enough to condemn the 100 yard bracket out of hand, but its practical advantages are so great as entirely to outweigh any theoretical drawbacks. The reduced chances which it involves become appreciable only at short ranges, where speed is as a rule far more important than meticulous accuracy, and it would be deplor-

* NOTE—The French normally use a short bracket corresponding to three times the Range-Table 50% zone, on the assumption that that latter is probable unduly optimistic.

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able if so essentially swift and simple a procedure, even were it not hallowed by tradition, were sacrificed on the altar of pedantic theory. It is however worth pointing out that in those rare cases where a target is being deliberately engaged at very short ranges, e.g. with an 18 Pdr at 2000 to 2500 yards, where the 50% zone is some 25 yards, a verified 50 yard bracket (corresponding to twice the 50% zone) is a useful preliminary to fire for effect and may in the long run save not only ammunition but time. It is also worthy of notice that with an 18 Pdr at ranges up to about 4500 yards, a plus-and-minus at the same elevation with its even money chance is theoretically rather more reliable than a verified 100 yard bracket.

It seems safe to say that of all the brackets we have examined the true short bracket verified is both theoretically and practically the most suitable for the object in view—the determination of that elevation which has a reasonable (even-money) chance of enclosing the target in the 50% zone. We have tried both larger and smaller brackets and found them wanting, but there is one question that we have so far ignored: Why be content with verifying the true short bracket? Why not verify it? Like most absurd questions, it is not too easy to answer direct; let us review the situation.

A true short bracket is as we know one in which the two elevations differ by an amount corresponding to twice the 50% zone of the gun, that is, there is just room for the 50% zone at the intermediate elevation to fit in beween those at the higher and lower elevations respectively without overlapping. An unverified short bracket gave us a ·39 chance that the target lay inside this intermediate 50% zone; verified, the chance rose to ·53; reverified, it will rise again. Consequently the more we verify the more certain we become that the target lies inside the intermediate 50% zone, and the less chance there is of its lying anywhere else, e.g. inside the 50% zone at either the top or the bottom end of the short bracket. In other words reverification gives us only the negative information. It tells us that both the elevations at which we are firing are probably wrong, and hence that the intermediate elevation is probably right. This is all very well in theory, and if we were merely looking for an answer to write down in our note-books nothing could be better; but after all our main object in ranging on a target is normally to hit it, and this is more likely to be achieved at the intermediate elevation of a verified bracket, which has an even-money chance of being right, i.e. of enclosing the target in its 50 per cent zone, than at the top and bottom elevations, which have a steadily increasing chance of being wrong.

So much for re-verification. The number of rounds to fire at the intermediate elevation, the deductions to be drawn from them, and the degree of accuracy to be expected, will be discussed in a subsequent article on Groups—and gambling.

Note 1. It occasionally happens that a true short bracket gives a contradiction, i.e. the higher elevation gives a minus and the lower a plus: What should A do next?

If the problem is worked out theoretically, it will be found that there is a ·76 chance that the target lies inside the 50% zone of the

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gun at the intermediate elevation; in other words, if A chooses the intermediate elevation he will be right three times out of four. So far so good, but there is another aspect of the question, also theoretical but with a highly practical bearing. A contradiction is most likely to occur when the target is exactly at the ultimate M.P.I. of the gun at the intermediate elevation, but even in these circumstances it will occur on an average only once in 125 times, i.e. the chances of its occurring are 124 to 1 against—longish odds. What are the odds against a careless lay, a badly tested sight, a wrong charge or a 'stumer' round all taken together? A's solution of the problem will depend on the quality of his belief in his battery and its equipment—but he might do worse than say 'Repeat'.

Note 2. It has been objected that these questions of brackets can be profitably considered only when all the rounds are fired by the same gun, on the grounds that no two guns however carefully calibrated will shoot exactly together, and that consequently the bracket will not have its face value. To meet this objection it is only necessary to point out that with any two reasonably well-calibrated guns each has prima facie an even-money chance of shooting longer than the other, and any bracket that they fire has in consequence an even-money chance of being bigger—or smaller—than it professes to be. The odds corresponding to the true bracket are in fact the mean of those corresponding to the various fluctuations of the bracket and though in any particular case they are unlikely to be scientifically exact they retain their practical value as a reasonable approximation.

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SOME EPISODES DURING BATTLE-FIGHTING ON THE WESTERN FRONT.

Continued from the August number of "The Journal."

Communicated by

MAJOR-GENL. SIR H. C. C. UNIACKE, K.C.M.G., C.B.

XXVIII. Initiative.

On the 25th March, 1918, three guns under Lieut. G. P. Chapman, R.F.A., which had been drawn from the Ordnance Gun Park to replace others that had been put out of action, were coming up via Peronne to join "A" Battery, 94th Brigade, R.F.A.

On nearing Peronne Lieut. Chapman suddenly seeing lines of German infantry advancing at close range realised that our infantry had withdrawn and that he was in between the two Armies.

He at once brought his guns into action with open sights, fired all the ammunition in his limbers, doing considerable execution and holding up the enemy's further advance for the time being, got his guns away from under their noses without mishap—joining up with his battery during the night.

This officer four days previous to this (21st) had been in charge of a forward gun of his battery (A/94)—the action of which has been described in Episode No. III.

XXIX. The work of a Driver.

On the 21st March, 1918, "D" Battery, 150th Brigade, R.F.A., was in action near Heudicourt. The guns were in a valley and the enemy drenched the position so heavily and continuously with gas shell of a "persistent" nature that it became at length impossible to continue firing with any semblance of efficiency.

A limber and a pair of horses came up in charge of No. 23015 Driver John Terry and, unaided, he moved the guns one by one out of the affected area on to the crest. Throughout the operation the enemy shelled the position with high explosive and the route was a track through shell holes.

The whole of the guns were got into their new position well within an hour, quite safely—the Battery continuing to fire throughout.

The endurance, resolution, and courage displayed by this driver were truly admirable—but for him the operation could not have been carried out; but in bestowing a well-deserved meed of praise on the man, those humble heroes, his horses, must on no account be forgotten.

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XXX. Action of a forward section.

On November 1st, 1918, a section of "B" Battery, 107th Brigade R.F.A., under command of 2nd Lieut. J. Clouston, D.S.O., M.M., was ordered to push forward with the leading infantry and act as an "anti-tank" section in case the enemy should counter-attack with tanks.

This section left the main battery position before dawn; passed through the village of Artres, which at the time was being very heavily shelled by the enemy; crossed the River Rhonelle by the only existing bridge, which was also being heavily shelled and came into action immediately in rear of the advanced infantry outpost line on the high ground 1,000 yards east of the Rhonelle.

At 9 a.m. the Germans counter-attacked with six Tanks, all of which were knocked out by this section at ranges from 200 to 300 yards. A section of "C" Battery, 107th Brigade, R.F.A., which had been detailed for the same purpose but further away to a flank, materially assisted.

The infantry outpost line was however eventually pushed back right on top of the section of B/107, which by this time had sustained a good many casualties both to men and horses from machine gun fire.

The section stood its ground and maintained a high standard of fire discipline. Laying direct at point blank range on the advancing enemy it held them up for the time being, and by knocking out completely three hostile machine guns one after another as they came into action steadied our retiring infantry who formed up by the guns and advanced again to their final objective.

For the remainder of the day this section remained in an advanced and exposed position engaging over the open sights any parties of the enemy who exposed themselves and completely dominating the situation in this part of the line.

Lieutenant Clouston was recommended for the V.C. by the 61st Division whose infantry he was supporting at the time.

XXXI. Action of the 20th Divisional Artillery Group on the 21st March, 1918, and following days.

Map References—France, Sheet 62D $\frac{1}{40000}$

The two Brigades of the 20th Divisional Artillery were ordered into action on the night of March 21st, 1918, as "re-inforcing" Artillery—the 91st Brigade, R.F.A., to assist in covering the 36th Division and the 92nd Brigade to support the 30th Division; both of which Divisions were heavily engaged.

During the great rear-guard battle which ensued these brigades time after time remained in action engaging the enemy at close range until after all our infantry had passed them.

On one occasion, near Savis, "B" Battery, 92nd Brigade, R.F.A., under these conditions, engaged at short range and completely destroyed an enemy battery coming into action against our retiring infantry—the Battery Commander observing from a tree in the line of guns.

On the 24th March, at Beines, the 91st Brigade, R.F.A., were in action covering the infantry who were retiring from the direction of Villeselve. About 5 p.m. the situation became critical as the

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infantry had retired through the guns and the Division on the right had practically ceased to exist, the remnants of it retiring past the right rear of the line of batteries. On the left rear the Germans were pushing on hot-foot through a big gap in our line from a northerly direction with every possibility of cutting off the brigade completely. As far as was known a few of our Cavalry were the only troops opposing his thrust from the North towards the immediate left rear.

As the 91st Brigade was consequently isolated holding the apex of the battle area at this point orders were given for two batteries to withdraw, one at a time, to a position west of Guiscard in order to cover the next crest in rear where a French Division which had just come up had started digging in.

As soon as these batteries had come into action in their new positions a third battery was withdrawn. The remaining battery, C/91, was ordered to hold on until dark. For two hours this battery engaged the enemy until the whole of its ammunition was exhausted —one section barraging the exits from Villeselve, now in possession of the enemy; one section engaging and holding up German infantry trying to debouch from woods on the right rear; and the third section firing on the enemy attempting to advance from the direction of Le Plessis. A very fine example of "all round defence" and a cool and resolute piece of work on the part of all ranks.

By the time the battery retired, Berlancourt, in rear of them, was in German hands, and the battery rejoined the Brigade by making a slight detour, passing through the village of Buchoire at dusk just ahead of the German infantry who were pressing forward to occupy it.

In the subsequent fighting the 91st Brigade, R.F.A., remained in action in its position 500 yards west of Guiscard, covering the withdrawal of the Allied troops until *after* the Germans had captured Guiscard and firmly established themselves there.

On the 25th March the infantry of the 20th Division were holding the line of the Quinquerry Canal. Shortly before 11 a.m. it became apparent that the enemy were working round on each flank of the Division. The 232nd Army Brigade R.F.A. was covering the infantry of the Division from positions east of Billancourt and the enemy movement in that quarter threatened to cut it off completely. It was therefore considered advisable to withdraw it while there was still time and orders were sent from Divisional Headquarters to that effect. About two hours later some of our guns were still heard firing at Billancourt. A Staff Officer was sent to investigate and found that "A" Battery, 232nd Brigade R.F.A., which had been ordered to cover the withdrawal of the remainder of the Brigade, was still engaging the enemy's infantry at close range over the open sights. A direct order had to be given to the subaltern in command, all other officers being casualties, to withdraw his guns—which order was obeyed with reluctance. At the time the German infantry were well round both flanks and the guns were in action in advance of the British front line.

On the night of the 25th/26th March the 20th Division infantry were relieved by French troops who took over responsibility for holding the line. The Artillery under the command of the C.R.A. 20th Division (Brig.-General H. W. A. Christie, R.F.A.) was however

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left behind to cover the French, whose guns were late in coming up owing to traffic difficulties.

During the course of the night the 20th Division infantry, as pre-arranged, withdrew in a north-westerly direction so as to gain touch with their own Corps (XVIII). This left a considerable gap between the French and the British, at Roye and to the North of it, which the former for some reason omitted to fill.

The gap was held by two brigades of British Artillery.—the 306th Brigade R.F.A. and the 307th Brigade R.F.A., both belonging to the 61st Divisional Artillery—with very few troops in front of them, if any at all. They narrowly escaped capture when retiring across the Avre, their extrication from what seemed at one time a desperate situation being entirely due to a display of the greatest skill and coolness on the part of all ranks.

On March 28th a section of "C" Battery, 315th Brigade R.F.A., put up a fine resolute fight in successfully covering the withdrawal of the 232nd Army Brigade R.F.A. across the River Avre at Castel. The section hung on until the last possible moment, forcing the enemy's infantry to bring up machine guns in order to turn it out and in spite of a good many casualties got its guns safely across the river and came into action again on the other side.

On April 4th the batteries of the 307th Brigade R.F.A. were in action in the vicinity of Ferme D'Anchin covering French infantry. The Germans, using the bridgehead at Moreuil which they had captured, attacked in great strength in the early morning from a south-easterly direction endeavouring to capture the heights of Rouvrel and thus turn the whole line of the River Avre.

The 307th Brigade put down a most effective barrage over the heads of the retiring infantry and after the whole of the French troops had passed through the batteries, remained in action firing over the open sights and inflicting extremely heavy loss on the advancing waves of Germans. The Brigade eventually only retired when the enemy were right upon them—every gun being safely withdrawn. The delay and losses caused to the enemy by the fire of these batteries saved the situation; giving time for the arrival on the field of the French reserves, who counter-attacked successfully from the direction of Rouvrel. A number of French officers testified to the "heroic resistance" offered by the 307th Brigade R.F.A. and the French Divisional Commander issued an "order of the day" specially commending "the skilful and gallant manner in which the guns were handled."

XXXII. 33rd Siege Battery, R.G.A.

On the 21st March, 1918, during the German attack on the Fifth Army, the forward section of the 33rd Siege Battery, R.G.A. (8 inch howitzers) came under heavy fire. It continued engaging the enemy until at length 75 per cent. of the gun detachments had become casualties.

The remaining gunners then manned one gun under the Section Commander, who himself combined the duties of No. 1 and gun-layer, and kept up a steady fire until 10 p.m., at which time orders were received to retire, as the enemy's infantry were working round the right rear of the position. One gun was safely withdrawn but the other

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had to be rendered useless and abandoned as the road had become so badly shell-cratered by the intense bombardment of the German heavy howitzers that it was impossible to get it along.

The rear section of this battery by 5 p.m. on the 22nd had fired 3,000 rounds—a weight of 300 tons of ammunition from two guns in 36 hours. At this hour the German infantry were only 500 yards from the guns which at the time were in front of our own infantry. The guns however were safely got away by three "caterpillars" under heavy machine gun fire and came into action again the same night

XXXIII. A driver's devotion.

In 1916 during the Battle of the Somme a G.S. wagon with a 6 horse team and a party of gunners under a N.C.O. was sent along the road between Pozieres and Courcelette to collect material from wrecked German dug-outs, etc., for the purpose of constructing a new battery position.

This duty was being carried out after dark, as the road by day was under direct enemy observation, and movement along it in daylight was consequently out of the question.

Soon after a start had been made the Germans began to shell the road—after a little time the shelling became intense and the party were compelled to pull up under a roadside bank in order to try and get some little shelter. Just as they did so a heavy shell landed in their midst, damaging the wagon rather badly and wounding more or less seriously the whole party, both men and horses, with the sole exception of the wheel driver. The terrified horses attempted to bolt but this driver succeeded in stopping them and quieting them down and clearing those who were rolling amongst the wounded men. He then proceeded to render "first aid" to his comrades, binding up their wounds and placing them in the most sheltered spot he could find—the road was quite deserted and there was no one capable of helping him.

Having done this he placed them on two horses who were less seriously wounded than the others and took them back, two at a time, to the nearest dressing-station.

When he had carried back all his comrades to safety in this manner, risking his own life every step of the way, he took off their puttees and went back alone along the shelled road to the remaining four wounded horses and utilized these puttees to stanch their flow of blood and bandage them up. He then somehow succeeded in getting the wagon clear and found that although badly knocked about it was still capable of being travelled at a walking pace. He hitched four horses on behind, hooked in the two strongest, and brought the whole lot slowly and painfully back to the battery wagon lines.

The night was black dark, the road was still being shelled and the man was entirely alone.

It is regretted that the record of his name has been mislaid but it is satisfactory to know that the humanity, devotion, and courage shown by him were rewarded at the time by the grant of the Military Medal.

(To be continued).

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CONTENTS OF LEADING FOREIGN JOURNALS.

Revue Militaire Générale—July, 1920.

I. The Military Forces of France (continued). Gen. Thevenet.

II. Ludendorff and the Allied Offensive of 1918 in Macedonia. Col. Kalafatovitch.

Col. Kalafatovitch was on the Serbian General Staff at this time. He quotes Ludendorff's short account of this campaign in which he attributes the Bulgar collapse to the Entente Gold and Propaganda, stating the Bulgars offered no resistance but merely abandoned their positions and retired.

Col. Kalafatovitch points out the falsity of this statement and describes Gen. Franchet d'Espery's offensive and the hard fighting preceding the Victory.

III. Organisation and Command of the Corps Heavy Artillery. Comdt. Perney.

IV. Military Legislation. Capt. H. Mirauchaux.

Bulletin Belge des Sciences Militaires—August, 1920.

I. The operations of the Belgian Army in the 1914-18 Campaign. (Continued).

II. The Mobilization and Concentration of the German Armies in 1914. Lt.-Col. A. E. M. Schmit.

III. The Belgian Army confronting the 1st German Army in August, 1914. Lt.-Col. d'E. M. Nuyten.

IV. Liaison between Infantry and Artillery. Lt.-Gen. Hellebaut.

Lecture given March 9th, 1920, to Officers of 9th D.I.

Mainly deals with grouping of Artillery units under Artillery Commanders, as opposed to acting on their own initiative or under the orders of Subordinate Infantry Commanders, as at the commencement of the war.

Discusses Artillery pushing forward with Infantry and the unsuitability of the 75 drawn by six horses as "canons d'accompagnement"—Unity of command of the Artillery making use of as many means of liaison with the Infantry as possible.—The necessity of each arm speaking the same (technical) language. Infantry officers should be trained in the methods of picking up targets used by the Artillery.

A group commander or experienced battery commander should be present at any Infantry Tactical Scheme embracing the use of guns.

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The good feeling between the Infantry and Artillery should be developed by frequent meetings in peace times.

V. On the "rôle" of the officer seen from the war. Capt. Comdt. Menzel.

Notes on German Inland Water Transport on the Western Front. (Militär Wochenblatt. 13 March. 1920.)

Revue Militaire Suisse—August, 1920.

I. From Charleroi to The Marne (concluded). Lt.-Col Poudret.

II. Recruiting. Lt.-Col. H. Thélin.

III. Reorganisation of the Infantry. (Continued). Major Schmidt.

IV. Foreign Notes.

France.—The law reducing the age limits of Colonels and Generals.—A scheme for making national physical training and preparation for military service compulsory.

Portugal.—The Army at work. Changes in Military uniform

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MEMORANDUM ON BOOKS.

This List of Books bearing on Subjects in Examinations for Promotion and for Admission to the Staff College is issued in order that Candidates may make Reference to such of them as they think fit, and Officers in charge of Libraries in the Service may consider which Books they would Select to Purchase as funds become available.

1. The re-introduction of examinations for promotion and for admission to the Staff College has entailed a re-casting of the syllabuses (*see* Army Orders 109 and 189 of 1920) and the inclusion of new subjects. It has never been the custom to prescribe books for examinations other than official publications, but it is felt that, after the long period during which no examinations have been held, commanders who are concerned with the instructions of their officers may feel at a loss in guiding the reading of candidates. With this in view this memorandum is circulated in order to lay before officers a list of publications which bear on these subjects. There is no intention of conveying that all or any of these books should be read from beginning to end; they are books of reference which officers in charge of the various libraries in the Service may care to consider for inclusion in their lists for the use of candidates.

2. As regards the period of Military History for the promotion examinations, it is well to remind officers that historical facts and details will not be required. It is rather a study of the campaign, read in conjunction with the various manuals of the Service, which is aimed at, and which will allow candidates to benefit from the experience of the past. At the moment the only official document bearing on the period is the despatches of the Commander-in-Chief. Until the Interim official history of the war is published it will not be possible to name any publication but these despatches.

3. For the study of Imperial Military Geography, Sub-head (b) (ii) for Lieutenants, and Development and Constitution of the British Empire, Sub-head (d) (ii) for Captains for promotion, and Imperial Organization for admission to the Staff College, a long list of works has been compiled. It is not claimed that it is a complete list, but it is sufficiently large to allow officers to select authorities to whom they may refer for details on the prominent questions. geographical, historical and constitutional which it is hoped that they will study in connection with this new and important subject in the curriculum of an officer. It is essential, now that the world has seen the whole Empire striving together in a common cause, that officers of the various forces of the Empire should study its geography and its history, and so become acquainted with the professional problems which affect it:

GENERAL STAFF,
WAR OFFICE, S.W. 1.
June, 1920.

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LIST OF SUGGESTED BOOKS.

LUCAS, Sir C. P. The beginnings of English Overseas Enterprise. 1917.
MILLS, J. Saxon. The Future of the Empire. 1918.
POLLARD, A. F. The British Empire. 1909.
LUCAS, Sir C. P. The British Empire (6 lectures). 1918.
WILLIAMSON, J. A. The Foundation and Growth of the British Empire. 1918.
WOODWARD, W. H. The Expansion of the British Empire. 1907.
LUCAS, Sir C. P. Historical Geography of the British Colonies (Dominions). 7 Volumes. 1906-17.

Vol. 1—Mediterranean.
Vol. 2—West Indies.
Vol. 3—West Africa.
Vol. 4—South Africa.
Vol. 5—Canada.
Vol. 6—Australia.
Vol. 7—India.

GEORGE, H. B. A Historical Geography of the British Empire. 1904.
KNIGHT, E. F. Oversea Britain. 1907.
MACKINDER, H. J. Britain and the British Seas. 1907.
EGERTON, H. E. The Origin and Growth of the English Colonies and of their system of Government. 1903.
JENKS, E. The Government of the British Empire. 1918.
JENKS, E. A short History of Politics. 1900.
DICEY, A. V. Introduction to the study of the Law of the Constitution. 1908.
BAGEHOT, W. The English Constitution. 1909.
SEELEY, Sir J. The Expansion of England. 1883.
LOWELL, A. Laurence. The Government of England. 1912.
LYALL, Sir A. C. The Rise and Expansion of the British Dominion in India. 1894.
HUNTER, Sir W. W. A brief History of the Indian Peoples. 1907.
FORTESCUE, Hon. J. W. A History of the British Army. 8 Volumes. 1899-1917. (*In progress.*)
CORBETT, Sir Julian. England in the Seven Years War. 1907.
MAHAN, Rear-Adm. A. T. The Influence of Sea Power upon History. 1890.
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GRANT, W. L. History of Canada.
BRADLEY, A. G. The Making of Canada. 1908.
WILLSON, B. Nova Scotia. 1911.
LUCAS, Sir C. P. Report on British North America by Lord Durham.
HOGARTH, Prof. W. G. The Nearer East. 1902.
BRAND, R. H. The Union of South Africa. 1909.
KELTIE, J. Scott. The Partition of Africa. 1895.
CROMER, Lord. Modern Egypt. 1908.
CAMERON, D. A. Egypt in the Nineteenth Century. 1898.
COLQUHOUN, A. R. The Mastery of the Pacific. 1902.
SCOTT, Ernest. Short History of Australia.
LORD, Walter F. The Lost Possessions of England. 1896.
JENKS, E. A History of the Australasian Colonies. 1912.
FAWCETT, C. B. Frontiers. 1918.
KEITH, A. B. Selected Speeches and Documents on British Colonial Policy. 2 Volumes. 1918.

Statesman's Year Book.
Colonial Office List.
Whitaker's Almanack.

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October, 1920.

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"DUNCAN" COMMENDED ESSAY, 1919-20.

"The Reorganisation of the Royal Regiment of Artillery with a view to obtaining in war the best value from modern equipments with a minimum of expenditure of human energy."

BY CAPTAIN R. HILTON, M.C., D.F.C., R.G.A.

"TEMPORA MUTANTUR."

EVEN in normal times it would be difficult to discuss adequately, within the allotted limits of this essay, such a vast and complex subject as the re-organisation of our regiment. Under present conditions a whole book would be necessary to deal fully with the subject. The great tactical lessons of the War, the tremendous development of aircraft, tanks, and mechanical transport, and the transitionary phase through which military and social ideas are now passing—all these have combined to necessitate re-organisation, but they have also created many possible solutions as to the future development of war. Artillery re-organisation must conform to the most probable of these theoretical solutions, and at present no clear indication has been given.

Hostilities ceased at a period when tanks and aircraft had proved to the most conservative minds that they had a great future before them, but they had not quite had time to show what form future warfare would take under their influence. Consequently we have nothing but personal theories to rely upon as to the future of war, and the most irreconcileably conflicting views are held on this point.

Between the equally fantastic ideas of those who uphold certain extreme theories, there are infinite shades of opinions—all quite feasible—as to the future nature of war. No one can say on which of these conflicting ideas the re-organisation of the R.A. should be based. Even if the form of tactics of the immediate future could be foreseen with certainty, it would be unwise to remodel the regiment exclusively on them. For the progress of science is so rapid, that the most up-to-date equipment of to-day may be hopelessly obsolete to-morrow, and financial expediency will not permit such frequent changes of equipment and organisation.

In fact the question of economy has a very important bearing on the whole subject, and in conjunction with uncertainty as to the future of war, is the chief difficulty in re-organisation. The need for economy forbids outlay to suit every changing phase of tactics, and it forbids any considerable expenditure on experimental work, which would give clues as to the future developments of tactics.

Yet artillery must keep pace with all these changing tactics, in order to be ready to take its proper part in any war of the future

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whenever it happens to break out. Its organisation must be such that—whatever the tactics of the moment may happen to be—batteries may always be able to take the field with up-to-date equipment suitable to the passing phase of warfare. To reconcile this idea with the need for economy in peacetime will be one of the chief problems of re-organisation.

Though nothing can be taken for granted in the affairs of the world at the present time, there are some grounds for assuming that another war on the scale of the last one is improbable for ten years at least. On the other hand it seems very probable that the British Empire will have a series of small wars and minor troubles on its hands for many years, and that these will necessitate the maintenance of small but well equipped regular forces. Finally, the last war has taught us the necessity, even in the midst of peace, of being guarded against sudden attack without any declaration of war.

These three considerations indicate what will be required of our armed forces in future. It does not follow that the army, still less that the Royal Artillery, will be concerned in carrying out all three of these duties, namely—Civilized Field Warfare, Savage Warfare, and Home Defence. It is true that up to the present all these three have come within the scope of our regiment, and have resulted in the maintenance of certain special branches—such as Coast Defences—which have not much in common with what may be called "true artillery work", that is artillery service in Civilized Field Warfare. Recently however certain other arms—notably aircraft—have developed to such a degree that certain duties in war, hitherto entrusted to Artillery, can now be performed more economically and efficiently by other arms.

The very title of this paper calls for economy of human energy, and it would be extremely uneconomical if we were to maintain in our re-organised regiment any branches whose work can be performed better by other arms. It is proposed, therefore, to start by discussing the present conditions of Savage Warfare and Home Defence, considering particularly the capabilities of aircraft and other modern scientific weapons. Civilized Field Warfare—by which is meant operations against a scientifically equipped field army—may be reserved for consideration later. It is in Savage Warfare and Home Defence that aircraft development has had, and will have in the near future, the greatest effect on the need for artillery.

SAVAGE WARFARE.

For this particular discussion savage warfare may be defined as hostilities against an enemy not equipped with aircraft, irrespective of what state of social civilization he may possess. Savage warfare may be divided into two classes (a) when the enemy possesses towns, villages, herds, or other property, the bombing of which will bring about his surrender, and (b) when the enemy does not possess any such property, or if he does, is indifferent as to how much it is bombed. Case (a) may be dismissed from mind at once, since obviously the R.A.F. will be able to conduct wars of this kind without any assistance from the army. The only troops which will be required to assist the R.A.F. will be those detailed for the local defence of aerodromes, etc. Artillery at any rate will not be re-

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quired, and therefore we need not concern ourselves with this type of war.

But though the R.A.F. will undoubtedly be able to do a great deal of the work formerly requiring punitive expeditions of all arms, it must not be supposed that aircraft will be an infallible panacea for all savage warfare. Many savage races who are likely to find themselves in collision with the British Empire are by their nature and habits immune from mere aircraft attack by itself.

Some may be nomads, who have no settled towns and villages to be bombed. Others may live in collections of mud huts, which they abandon during hostilities, taking to the bush or hills instead, and so presenting no target to bombing aircraft. In fact it is extremely probable that all uncivilized races will adopt these methods after a taste of aerial bombing. Consequently the value of aircraft in punitive work will diminish, when uncivilized enemies realize the ease with which men on the ground can conceal themselves, and the damaging effect of rifle fire against low-flying machines.

Against races who adopt such tactics it will still be necessary to send ground troops, and in order to succeed against such elusive enemies the expedition must be very mobile. This has always been the problem in savage warfare: an expedition of all arms, however small, is always a cumbersome and slowly moving force compared to a lightly armed enemy with no transport. The result is that "small" wars of this kind are apt to drag on interminably, till the enemy gets tired of fighting and gives in without having fought a really decisive action. Consequently it is often not long before the same enemy gives trouble again, not having experienced the salutary effect of a severe defeat last time he did so.

This problem of "small' wars seems likely to assume considerable importance for the British Empire during the next few years. Unless we want the expense of maintaining everlasting expeditions, we must devise some means of ensuring that tribes who have been "punished" once do not give any trouble again for several years.

The only way is for our forces to be so mobile that they can force the enemy either to scatter and return to their homes at once, or stand and receive a decisive defeat. We can no longer afford the old type of marching columns, encumbered with transport, and dependent on long lines of communication. We must have columns whose transport does not encumber them, and who are independent of lines of communication. There should be no long columns of mules, which in mountain warfare make quite a small force take up so much road space, and render it slow and vulnerable. In African fighting the tsetse fly makes animal transport even more of a nuisance: therefore coolies have to take the place of animals, thus still further increasing the length and unwieldiness of the column.

Modern weapons and equipment can alter all this, and provide a small compact fighting force, sufficiently powerful for any uncivilized enemy, and yet sufficiently mobile to force him to fight. Later in this essay the opinion is expressed that armies in civilized warfare will develop tremendous mobility through the use of tank-transport, and that the artillery of the future will be Q.F. guns mounted on tanks. Whether this is a true forecast of civilized warfare or not, it is the obvious solution for savage warfare in country fit for the use

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of tanks. In such country expeditionary forces will consist of tanks—infantry-carrying tanks and tank-artillery—capable of moving at twenty to thirty miles an hour. With such weapons against uncivilized enemies the forces employed could be small. Therefore casualties would be small, also requirements of rations and small arm ammunition. The road-space occupied by tanks carrying a certain weight of stores is infinitesimal compared with that of animal transport carrying the same weight. Therefore columns and convoys could be compact and mobile. Petrol supplies could be ensured by large weight-carrying aeroplanes.

There remains to be considered savage warfare in mountainous, swampy, or forest country, unfit for the use of tanks or tank-transport. The only form of artillery which it is possible to use is mountain artillery. Mountain artillery is extremely weak in shell-power and range, but requires considerable numbers of mules and men. Does the conduct of operations benefit sufficiently from mountain artillery to justify the lack of compactness and mobility conferred by all this extra transport? It is all very well to say that mountain artillery is as mobile as infantry or more so. The point is that it necessitates extra mouths to feed, extra ammunition to be carried. Unless the transport expended on these rations and this ammunition is doing the maximum possible good to the column as a whole, then the mobility of the column is suffering by the presence of mountain artillery.

If, for instance, the same transport was carrying machine-guns, and keeping the personnel of these machine guns supplied with rations and ammunition, it is an open question whether the fighting power of the column would not be greater. The value of the machine gun in defence was well known before the war. Its enormous value in attack has been one of the great tactical discoveries of the war. This value would be most pronounced in wooded, broken, or mountainous country, where the covering fire of machine guns would not be masked by the attacking infantry. Some other advantages of machine-guns as compared with mountain artillery are:—

(1) More mobile both on the march and in action.

(2) More adaptable to various situations likely to occur in broken country, e.g. ambushes, etc.

(3) Better able to take advantage of small natural features for cover, and the ideal weapon to seize opportunities for "infiltration" of the enemy position.

(4) Moral effect much greater than mountain artillery. Material effect at close ranges very great. Able to take advantage of fleeting opportunities.

(5) S.A.A. can easily be dropped by aircraft, thus relieving transport. Mountain artillery ammunition could not be supplied in great quantities by this means.

After all, the existence of mountain artillery is merely a concession to the idea that a force must possess artillery of some sort. But now that machine guns, Lewis guns, rifle grenades, and other infantry weapons have developed to such an extent that well-trained infantry can provide their own covering fire, surely it is time that

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ideas of that kind were modified. One form of help which machine guns cannot give is that of smoke-screens, but this work can be carried out by low-flying aircraft.

A force of infantry with a very large number of machine guns would be much more efficient than the same force accompanied by a small number of mountain guns. The former would require less transport. In attack the covering fire of machine guns would keep down the heads of the defenders, while the field of view of the defence would be further obstructed by smoke bombs dropped by areoplanes. In defence the value of machine guns needs no remark. If it became necessary to destroy a village or fort, the work could be done by bombs from aircraft.

Star-shell fired by mountain guns at night would have to be dispensed with, but otherwise there is nothing essential that a small expeditionary force would lack, through operating in mountain or forest warfare without artillery. Mountain artillery is therefore an unnecessary expense, and an encumberance rather than an aid against a mobile enemy.

Out of the three possible types of savage warfare one will be carried out entirely by the R.A.F. The second will require the use of the same kind of mobile mechanical Q.F. batteries as will be used in future civilized field warfare. The third will require infantry and machine guns, but no artillery. Of the three types, the second will probably be most common, so the ordinary (mechanical) field artillery of the future will uphold the "Ubique" tradition both in "small" and "civilized" wars.

HOME DEFENCE AGAINST ATTACKS BY SEA AND AIR.

It is commonplace knowledge that no up-to-date military power pays much attention to formal declarations of war. When relations become strained between two great nations, one or other will almost certainly attempt to strike a surprise blow before the actual rupture of diplomatic relations. In the past, this blow, as far as the British Empire was concerned, was considered likely to be an attempt to cripple our fleet by a destroyer attack. In future it may take the form of bomb raids on a vast scale against our industrial areas, mobilization centres, and against London. Or an attempt may be made against our fleet by means of coastal motor boats, torpedo-carrying aeroplanes, or submarines.

In fact, it is essential that our coasts should be guarded even in normal times of peace by coast-defence and anti-aircraft organisations sufficient to deal with sudden attack.

This brings up once more the vexed question of coast defence artillery, and a fresh question of anti-aircraft artillery for home defence. Even before the war much argument was expended for and against the handing over of coast defence batteries to the Royal Navy.

It seems probable that the question will solve itself in an entirely unexpected way—namely by coast defence artillery ceasing to exist! In these days of torpedo-carrying aeroplanes, fighting aeroplanes, submarines, C.M.B's, and mines, there is nothing that coast batteries can do in coast defence, which cannot be done much better and more economically by another arm. Coast batteries mean that money

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expended on defence is tied up and limited to a small area of coast, whereas if expended on aircraft or other more mobile means of defence, the whole coast could be guarded for the same sum of money.

Attacks of any sort by surface-ships will be countered in future by torpedo-carrying aeroplanes before the attackers get within twenty miles of the coast. Attacks by "scooters" are far more likely to become the normal method, and these boats owing to their great speed are very unlikely to be stopped by coast batteries. The raid on Kronstadt harbour is an illustration of the powerlessness of coast batteries to keep these boats out of a harbour. If however the enemy had been able to send up even one fighting aeroplane at the time of the raid, it could have machine-gunned the C.M.B's out of action one after another before they got anywhere near the battleships.

Even for close defence at night, when coast batteries might reasonably be expected still to hold their own, the war has shown them to be useless in face of smoke-screens, etc.—for instance at Zeebrugge and Ostend. Generally speaking, the whole naval war showed that more and more extended defence will be the principle in future—the intended enemy attack must be located and frustrated as far out to sea as possible. Hence aircraft, submarines, dark night patrols etc., are the true means of coast defence in future. Coast defence artillery is already obsolescent.

Anti-aircraft artillery *for home defence* is another branch of artillery whose very existence is unsound. Up to shortly before the armistice its existence was justified by the fact that aeroplanes could not fight one another at night. Therefore, the only way to molest and interfere with bombing machines was by anti-aircraft artillery. Now however machines can fight one another at night, and pursuit machines can be guided to their victims, the bombers, by wireless telephonic communications with the ground.

It is common knowledge that, as a counter-measure against bombing, fighting aeroplanes are immeasurably more efficient than A.A. Artillery. That is why long distance bomb-raids were confined to night-time, for the bombers then had nothing to fear but A.A. fire. The regularity and persistence with which bombing was carried out shows how insignificant was the deterrent effect of "Archie". On the other hand daylight bombing was almost entirely suppressed by the power of fighting aeroplanes. This power can now be applied against night-bombers, and will provide a far more efficient defence than A.A. batteries can ever do.

Expenditure on A.A. batteries provides defence for a limited area only. The same expenditure on fighting aeroplanes protects all the country within flying distance of the aerodrome. From the points of view of efficiency and economy A.A. batteries for home defence work must give place to squadrons of fighting aircraft.

It must be clearly understood that the A.A. artillery *with the field army* is not included in this argument. A.A. batteries with the field army have, and always will have, a great and essential rôle, which those used for home defence have not got. The only possible object for the latter is to keep bombing machines away from an

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objective, and the war has shown that they are useless for this purpose, except at a prohibitive cost in guns and ammunition. As a means of destroying aircraft or keeping them away from an objective anti-aircraft guns are useless. In home defence work therefore they ought to be abolished, and give place to fighting aircraft. But in the field the rôle of anti-aircraft artillery is one which fighting aeroplanes cannot carry out. What this rôle is will be discussed later, but for the present it is sufficient to point out the distinction between A.A. work in the field and at home. In the former, "Archies" had, and will always have, an essential part to play; in the latter they can do nothing which cannot be done better by fighting aircraft. They cannot even do the work that is their object of existence. Therefore they should be abolished, and the work of home defence against air-raids should be left entirely to the R.A.F.

Both in coast defence and home defence against aircraft the work hitherto carried out by artillery will in future be done more economically and efficiently by other arms. On the other hand the importance of artillery in civilized field warfare is steadily increasing. In civilized field warfare we are certainly about to witness far-reaching tactical changes. The development of aircraft and tanks make that inevitable. The rôle of artillery will still be as important as it is at present, but its material and methods will have to undergo great changes. We want to "obtain the best value in war from modern equipments". This will require extensive experiments and research, and every available penny allotted to artillery services ought to be devoted to research work. We want to do all this with the "minimum expenditure of human (and financial) energy". Let us therefore abolish coast-defence artillery, home-defence anti-aircraft, and mountain artillery—all out-of-date branches of our regiment superseded by the progress of modern arms.

We can start off then with the assumption that the Royal Artillery in its re-organized state will only be concerned with equipping itself for field operations:—

(a) On a similar scale to those of the recent war.

(b) On a small scale in intermittent "small" campaigns, but only when they take place in country fit for tank transport.

The force designed for the former eventuality will be no more than a skeleton force in peace-time. Its permanent personnel will be occupied in extensive experimental work, dealing with every fresh development of science or war which may exert any influence on artillery tactics.*

The personnel of the force intended for the latter duties will be almost continually engaged on active service, or in immediate anticipation of it.

It is suggested then that the re-organized regiment should be divided into two types of units, which may be called for convenience First and Second Line, both being composed of regular personnel.

On the outbreak of war involving general mobilization, the First Line Artillery would be available at once as part of the

* This will be the only means in future by which professional armies will be able to influence the results of wars between great nations. They will rarely act as integral fighting forces, but rather as the brains and framework of huge national armies of which only the cadres will exist in peace-time.

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Expeditionary Force (or First Line) of the Regular Army, in case circumstances required immediate action by a small mobile force. The Second Line Artillery would be available as an artillery nucleus for our Second Line (or National) Armies, for training and equipping newly raised batteries manned by universal mobilization. In process of time the the First Line Artillery would be reinforced by these new batteries, and both would merge into one homogeneous service.

No individuals, particularly no officers, should be left for more than a certain time—as short as practical experience shows to be possible—in either of these two branches. In this way the Second Line (or Cadre) units would be continually being inculcated with new ideas generated by active service experience. At the same time the First Line units would have the benefit of the latest theories of warfare on the grand scale, which would constantly be brought into them by newly transferred officers, and which could be modified and adapted to whatever "small war" might be in progress.

Critics have been known to say of the British Army that it entered upon the South African War prepared for the Crimea, and that it went to Flanders full of the lessons of South Africa.

If this is true, it can only be because our collective military mentality becomes too much imbued with the notions of the passing, or most recent phase of warfare, to the exclusion of others which might arise in different circumstances. For instance, the numerous small wars, in which we had been engaged, undoubtedly made the average officer before 1914 think in terms of divisions and brigades, where the average Frenchman or German thought in armies and army-corps.

After all, the principles of war are the same whether the enemy are Germans or African natives. It is not that there are two distinct types of war—civilised and savage—but rather that there is an infinite variety of natures of war with exactly the same bed-rock principles.

No one can possibly learn all the different natures of war separately. If anyone attempted to do so, they might find themselves involved in a war under different conditions to any which they had studied, and so their ideas would be all wrong. If there is any truth in the above criticism of the British Army, it must be because more attention has been paid to the outward and visible features of particular wars than to the basic principles. To avoid this, some such organization as the above should be adopted. The fact that every officer will in turn be engaged for short periods in each branch, will prevent him from getting narrow-minded. The practical experience obtained in small wars will be leavened by the consideration of problems connected with "massed" wars. The mental process of reconciling the two lines of thought will develop elasticity, adaptability, and the power of independent reasoning in the minds of all officers. The basic principles of war will be implanted instead of a lot of intimate details, which may be true of one type of war but have no place in others.

It is necessary to lay considerable stress on the above point—even at the risk of redundancy. It is the old problem of training over again—whether to specialize, or aim at a wide general knowledge. The British Army may have to fight in almost any type of

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war imaginable. Specialists are invaluable when doing the work in which they specialize, but when faced by a different set of circumstances they are usually more "at sea" than ordinary men. This is because the nature of their training tends to atrophy their powers of mental adaptability.

The personnel of our army, specially the officers, must be so trained as to be ready for any circumstances and conditions of war. Therefore the wider and more varied experience they are able to get during training, the more efficient they will become.

Let us therefore have one homogeneous regiment, the personnel of which are so trained—or rather so mentally developed—as to be able to turn their hands to any imagineable form of artillery service in any possible circumstances of war. Our military organization must be prepared for continual small wars as well as for another "world" war. Let us meet the problem, not by making our personnel specialize in one or the other, but in creating one homogeneous artillery personnel fit to take part in either.

It is hardly necessary to point out, that in pursuit of this object our present obsolete and anomalous division of the regiment into Field and Garrison should be scrapped at once. The abolition of coast defence artillery and of all anti-aircraft artillery, other than that which will be a mobile part of the field army, seems (as discussed above) to be a natural result of aircraft and other development. With their disappearance all artillery, both Field and Garrison, will in future be exclusively mobile armament forming part of the Field army, and there will be no further reason to maintain this artificial distinction. In future there will be no dividing line by which artillery will be able to be defined as being either Field or Garrison.

In fact there is no longer any reason why there should be any distinction. During the early part of the war R.G.A. batteries were handicapped by lack of intimate knowledge of field tactics. This ought not to have been so, and was merely the result of this artificial distinction, which prevented R.G.A. personnel from broadening their minds in this important direction. On the other hand R.F.A. batteries were backward throughout the war in aerial co-operation, due largely to narrow-mindedness brought on by specializing in one small branch of artillery work. In future all gunners without distinction will have to be intimately acquainted with field tactics, and all will have to be able to work with aircraft and all other aids to observation and direction of fire.

So far the conclusions arrived at may be summarized thus:—

(1) A re-united regiment, Field and Garrison distinction being abolished.

(2) Its scope to include all artillery used with the Field Army (including anti-aircraft).

(3) No artillery for stationary defence (Coast Defence and Home Defence A.A. to be obsolete).

(4) Certain units maintained continually at war strength (for small wars, etc.) No mountain artillery.

(5) Certain units—the majority—to be cadre formations in peace-time, and their personnel to be employed in studying and experimenting with all developments of science, tactics,

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etc., which may modify artillery equipment or the principles of its employment.

All these principles must be adhered to in order to obtain the desired result, "the best value from modern equipments with the minimum expenditure of human energy": and perhaps out of the five, the last-mentioned principle is the most important of all. Let us economize during peace-time, both in men and money, by maintaining establishments on a cadre basis only: let us avoid heavy outlays in providing artillery equipment, which may be rendered obsolete by some new development soon after it is issued. On the other hand let us make sure that when war does come, we can get the "best value from modern equipments". This will require extensive research and experiments, in order to know what the very latest equipments are, and how to make the best tactical use of them. It will require a smoothly-working organization, carefully prepared in peace-time, to ensure that the mass-production of the latest equipments can at any time be undertaken by the factories best suited by their normal work for the purpose.

PROBABLE FORM OF CIVILIZED FIELD WARFARE IN FUTURE.

Before going on to consider the details of organization which will be required, let us determine the various possible forms of tactics which may characterize land warfare of the future. For though the conclusions already arrived at—the maintenance of experimental establishments rather than commitment to outlay on any definite form of war material—though these conclusions are sound whatever tactical developments the future may bring, yet they are nothing but general principles.

In order to establish experimental units we must know the lines of possibility along which experiment is required. For instance, it would be useless to equip any experimental units with the necessary means to carry out experiments in counter-battery work, if there appeared to be a probability of all war being carried out in the air. So we must first of all study the whole question of future warfare in the broadest possible aspect. From such a study it will be found that certain branches of artillery work—hitherto of great importance—will have no place in future warfare. Certain others which have sprung into prominence during the late war, and which appear to have a great future, will prove to be only freaks of armament due to the peculiar circumstances of this particular war. Such a study will show various branches of artillery work, which are likely to be of the greatest possible importance in the future. Experimental units can then set to work developing each of these artillery possibilities instead of wasting time with obsolescent armament.

To obtain true results from a study of future tactical possibilities, it must be carried out in a spirit of absolute broad-mindedness. It must be in no way influenced either by the "equestrian tradition" or "horse craze" on the one hand, or by pedantic love of abstruse gunnery calculations on the other. If these things are found to stand in the way of development more suited to warfare of the future they must be abandoned. Similarly we must not be led astray by the highly imaginative ideas propounded by journalists and others, who

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rush to the most extraordinary conclusions about the future of aerial warfare or any other striking development, without having taken the trouble to consider what limitations may exist to the use of the arm which has excited their imagination. Finally we must not be influenced too much by our practical experiences during the late war. If we were expecting another big war immediately, we could not do better than adopt the tactical ideas with which we ended the war. Our tactics and equipment are very up-to-date for the warfare of to-day, and so we do not need to worry about them. What we want to do it to find out by experiment the tactics and equipment of the next war, and determine what part artillery will be expected to take.

One of the first thoughts to strike one in considering the future must be the thought of aircraft. So much irresponsible prophecy—plausible at first sight but really based on very flimsy data—has been propounded on the subject, that rather exaggerated ideas about the future of aircraft in war have obtained a footing in the minds of large numbers, not only among the general public but in the army and navy also. There is a certain school of thought which believes that, within twenty-four hours or so of the outbreak of hostilities, one belligerent will have sent an immense aerial fleet over its opponents capital or other vital area and reduced it to ashes.

The exponents of this doctrine entirely ignore the following important facts:—

(1) Every civilized nation in the world will possess as well-equipped an air force as it can afford.

(2) In any stage of aircraft development, a machine laden with bombs and fuel for a long journey will always be at the mercy of a fighting machine laden only with machine guns and sufficient fuel for a short flight. That is to say, the defence (aeroplanes fighting in their own country) will always be stronger than the attack (bombers and their escort which have come a long distance).

(3) The improvement in location apparatus will ensure that raiders cannot cross the coast or frontier undetected, even if invisible from the ground. Fighting machines can be directed towards the enemy, even when in the air, by wireless telephony from the ground. Fighting machines can now find and attack hostile machines at night, which was not so during the war.

For these reasons it will be necessary first, to obtain air superiority before bombing the enemy country; and air superiority, unlike sea command, cannot be obtained by a decisive battle between the two air forces. It can only be obtained as the result of continual operations by offensive patrols wearing down the fighting spirit of the enemy.

In fact, so far from aircraft finishing off a war within twenty-four hours, it will be some considerable time before either side can make its air force felt in a decisive way. To say this does not in any way detract from the overwhelming importance of aircraft—an importance which must be universally admitted. Their importance indeed will be so overwhelming that, unless the war ends before one side has obtained air superiority, that side must inevitably win, whatever else may have happened on land or sea.

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The only way in which armies will be able to decide the issue will be by doing so *before the air struggle has reached a decision.* Armies will be designed, armed, and organized primarily for seeking an early decision, the victor then seizing all aerodromes, depôts, and aircraft factories, and so destroying the enemy air force. Can armies be given the necessary mobility and hitting power to obtain quick decisions, or will they always relapse into a long-drawn stationary warfare struggle?

It all depends on the relative strength of attack and defence methods, and now a weapon has been evolved which gives the attack a superiority over the defence which it has never had before. This weapon—the tank—is likely to provide armies with the necessary means of obtaining quick decisions. Armies of the future must obtain quick decisions or none at all. They must possess mobility and hitting power in the highest degree. Tanks will give armies this mobility and hitting power, and so justify the existence of the land service, as the service which will make its strength felt before that of the Air Force or Navy.

Tanks of the present day can travel at twenty miles an hour, and run for a thousand miles without need for repair. They can cross practically all obstacles, and it is believed that they will very soon be able to float. The idea of an invasion by thousands of tanks must be accepted by all countries with land frontiers as soon as nations can afford to build them in such large numbers. What means are there of stopping such an invasion? Up till now artillery fire has been the most efficacious defence, but tanks were comparatively slow machines during the late war. Considerable modifications in artillery methods and equipment will be required to deal with masses of tanks advancing at twenty miles an hour.

So far as the actual armament is concerned, there would not be much need for improvement. A small calibre (6 to 18-pounder) Q.F. gun firing H.E. shell is the ideal weapon *if it can be got to the right place in time.* No country can maintain a line of anti-tank guns all along its frontiers, and even if it were possible the principle is unsound. The mass of tanks would hurl themselves suddenly on one sector of the line; a few would be knocked out, but the rest would overwhelm the anti-tank guns and get through. The only possible form of defence is to have artillery which is as mobile as the tanks or more so; then to find out where they are advancing, concentrate this mobile artillery, and fall upon them in superior strength.

Assuming then that the 18-pounder gun is a satisfactory weapon, how must it be mounted, and what must be its means of transport, in order to travel across country, independently of roads, at twenty miles an hour? The two great desiderata for an artillery weapon have always been Hitting Power combined with Mobility. At last there is a carriage which will give both these qualities in the highest degree, and which will enable the gun to be fired while actually in motion, a power never achieved by any artillery equipment before.

Obviously the future artillery weapon should be the tank—or rather the Q.F. gun mounted on a caterpillar carriage, and capable of firing while proceeding under its own power. In a war of such rapid movement as the next land war must be, there will be no place

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for such slow moving weapons as artillery of the present day, except perhaps for the attack and defence of fortresses.

There seems to be a probability of the Tank Corps as such being abolished. If so, it is essential that the development of tanks should not be neglected for this reason, and there is no other arm which can more appropriately adopt this weapon than the Royal Artillery. After all, tanks are only mechanically propelled armoured batteries—at any rate, those armed with guns. In their essential characteristics they are merely a form of "Accompanying artillery", and this work of supporting infantry will always be their main duty in battle. In spite of their rapidity of movement when actually in battle they will always be dependent on infantry for their safety—as will be seen later—and they will in turn assist the advance of the infantry by their fire. Work of this kind is essentially artillery work, and the weapons employed in it—whether called tanks or guns—should belong to the Royal Artillery. If the Tank Corps is re-established later on, there will be other quite distinct duties for it to carry out—the independent action of tanks off the main battle-field, etc.

The probable battle-form of the future will be as follows. The invading force—consisting of artillery tanks and infantry or men-carrying tanks—will be located by aircraft or motor-cyclist patrols, and its strength and direction of march reported. It will be accompanied by squadrons of aircraft, which will establish aerodromes as close as possible behind the advance. In order to protect these aerodromes from motor cyclist patrols working round the flanks, the invaders will have to advance on a broad front preceded by infantry, whose duty it will be to discover mine fields, and "mop up" parties of infantry who might otherwise rush the tanks from cover. (N.B.—There is now a grenade capable of destroying a tank, which can be fired from an ordinary rifle). Tanks in hostile country will therefore always have to be *preceded* by an advanced guard of infantry, who will deploy from the infantry tanks. Thus their pace in hostile country will be limited to the marching pace of infantry, whereas those of the defence, being in their own country, will be able to move at full speed. The invading force will have to advance on a fairly wide front, and its dispositions will be impossible to conceal from aircraft. The defence will be able to concentrate somewhere on the line of march, and keep his dispositions concealed by remaining more stationary. The defence will therefore still have certain advantages, which will probably balance numerical superiority on the part of the attacker. The main point is that when the decisive action takes place, it will be short and very decisive. The general principles of tactics—combined action of artillery and infantry—will remain the same.

The above is sufficient to show that there will be no room for any other artillery weapon but Q.F. guns mounted on Tanks, nor will there be any need for other weapons. The exact design would be decided by experiments. Probably it would be found possible to manage with much less armour, as the guns would not normally fight among the enemy infantry but from immediately behind their own. The hitting power and mobility could be correspondingly increased.

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Direct fire would be the normal method, but experiments could also be carried out with indirect fire for use in rearguard actions, etc.

Ideas such as this may seem preposterous at present, but so would our present-day ideas of artillery have been only a year or so before the war. People then would have found it difficult to believe in the possibility of long periods of stationary warfare, such as were experienced on the Western Front. So now we find it difficult to believe in such a totally different kind of war to that which we know by recent experience. But it is bound to follow, as the natural result of tank development. The measures adopted or suggested against tanks during the war (such as anti-tank guns or barrages) were only the final struggles of "stationary line warfare" to maintain its existence. Given sufficient numbers of tanks of sufficient mobility, and any ideas based on holding a line against them become useless. There will be no time to establish the conditions of stationary warfare. So all tactical ideas based on such conditions must give place to the idea of a *mobile manœuvring mass*. Q.F. guns on tank mountings are the only form of artillery suitable for the rapid movements and decisions of the next war.

Even in this form of warfare the first few actions may be indecisive, owing to the principal masses of the two belligerents not having yet become engaged. A considerable period may therefore elapse before the decisive battle, during which time the two armies will each have occupied the territory through which its lines of communication pass, the only difference to this war being that the two occupied areas will be separated by perhaps twenty miles of disputed country, in which both sides will be continually carrying out raids and patrols. Neither side will be able to have railheads, aerodromes, or dumps in this disputed area, all these being kept back in the L. of C. area behind. Aerial reconnaissance therefore to be of any value, will not pay much attention to the intervening disputed area or "area of manœuvre". To gain information which will show the enemy's real intentions, it will be necessary to keep his railhead and aerodrome area under continual reconnaissance. The main bulk of aerial work will therefore be over the area beyond the fluctuations of the rapidly moving front—over country more or less permanently held by the enemy.

Similarly his aircraft will be compelled to work continuously over country more or less permanently held by us, and therein lies the great value of anti-aircraft artillery *with the field army*. A.A. guns used in home defence are purely defensive weapons dependent on the enemy's initiative. A.A. guns with the field army are nothing of the kind, for they can be put in positions where the enemy *has no choice* but to fly over them day after day and expose himself to their fire. Therefore they are as offensive a weapon as anything else. Besides this, in home defence they are intended to keep aircraft away from a locality—a job which no A.A. guns will ever be able to do. With the field army, however, they are, or should be, intended to:—

(1) Wear down the moral and efficiency of the hostile flying personnel by continually harassing them while at work.

(2) Act in close co-operation with the R.A.F. by assisting to point out hostile aircraft, and generally giving our own aircraft

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information tending to help them in the struggle for air superiority.

Anti-aircraft artillery with the field army will therefore continue to be of very vital importance, and experimental work should be undertaken with a view to improving its efficiency in these two respects. The second ideal is mainly a matter of close liaison with the R.A.F. and provision of suitable location sets and searchlights. The first is a question of artillery equipment. There is no doubt that a more efficient A.A. weapon could be designed than was available during the war.

There is no need for A.A. guns to be as mobile as other artillery. There is no reason why they should not be provided with a concrete mounting, and thus obtain the strength of carriage which a proper A.A. gun should have. Extremely high muzzle velocity is the main requirement of A.A. guns, and no mobile carriage can be designed to stand extremely high muzzle velocities at high angles of elevation. But if concrete mountings are permissible, a really efficient A.A. gun could be designed; and there seems to be no tactical objection to permanently sited A.A. guns. As has already been said, they are only required in areas permanently occupied by their own army. If the enemy makes an advance into this area, the guns must simply be destroyed and abandoned. The risk of this will be compensated for by increased efficiency of the equipment.

The second sphere of experiment should aim therefore at designing an A.A. gun on a concrete mounting with a muzzle velocity hitherto unattained. For instance, it may be possible to design a 3-inch gun of 80 calibres firing 8 or 10 C.R.H. ammunition with a "stream-line" base. The German "Big Bertha" has shown what can be done in the matter of high velocity design, and it seems as though the ideal A.A. gun could be evolved by developing small calibre guns on similar lines.

Having determined the probable tactics of the future, the organization of experimental units can be discussed in more detail. Experimental brigades could be established in various centres, each brigade to carry out experimental work in a certain particular branch. Experimental brigades should be established for the following work:

(1) Tactics and design of mobile mechanical Q.F. batteries for the field army.

(2) Design of A.A. batteries, research in A.A. gunnery, co-operation with R.A.F., and evolution of suitable A.A. location apparatus and searchlights.

These experimental brigades must keep in continual touch with similar establishments of other arms, and must give all developments in other arms the closest consideration, to find out whether they are likely to influence artillery tactics. In fact it may become necessary to establish other experimental brigades from time to time. For this reason, though tactics may obviously be tending in the direction described above, we must not commit ourselves to the adoption of these or any other particular types of armament, nor expend any outlay on them other than the amount required for experimental work. At the same time experimental brigades should be formed to consider, in the most broad-minded way possible, certain outstanding artillery problems of more immediate importance for the moment

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than the two already mentioned, even though they may be superseded by these more advanced problems before long. The problems of the immediate present which require solution are:—

(1) Animal or mechanical transport for artillery?
(2) Adaptation of existing equipment for anti-tank defence.
(3) Direct or Indirect fire the main means of anti-tank defence?
(4) Correct proportion of heavy to field artillery, and the natures of heavy artillery most required.
(5) Chemical and other special forms of ammunition.
(6) Improvements in artillery and aircraft co-operation, specially for field artillery.

All these will be rendered out-of-date before long by the prevalence of the ultra-mobile form of warfare discussed above. They must, however, continue to exercise our minds for the present, in case another war breaks out before mechanical development brings about this change in the form of war; but we must not commit ourselves to any form of artillery equipment suggested by the above problems.

New designs of Q.F. guns mounted on tanks, or other experimental productions, could be supplied to fighting units engaged in small wars, in order to be tested under various climatic and topographical conditions.

But apart from this, output of any particular types should not be undertaken in peace-time, till we become quite sure of the trend of future tactics.

Not only must we avoid committing ourselves hurriedly to preconceived ideas so far as material is concerned, but we must also continue to maintain our artillery training on the broadest possible lines. For instance, even if the horse goes out of use as a means of artillery transport, it would be very unwise to give up the instruction of all artillery officers in riding and horse-mastership. No one can be sure that circumstances might not arise again, which might preclude the use of mechanical transport. On the other hand in the extremely mobile form of warfare of the future, there may be no time or need for abstruse calculations or knowledge of the more advanced principles of gunnery. But on no account ought the higher science of gunnery to be neglected, even if it may fall into temporary disuse. A fresh evolution in tactics might render it as necessary again as it is to-day. In times of rapid change and uncertain development such as the present, the only safe principle is to have personnel ready to undertake any artillery work, and factories ready to turn out any kind of artillery equipment.

SUMMARY.

General principles should be—commit ourselves to nothing: experiment with all possibilities. Consider war from broadest possible aspect, and abolish branches of artillery which are undoubtedly rendered obsolete by the progress of other arms. Cultivate adaptability, so as to be prepared for any imagineable form of artillery service in any possible circumstances of war.

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A HISTORY OF ARTILLERY.

PART III.

FROM 1756 TO 1783: "UBIQUE".

By Ralph Flenley.

(Continued from page 298).

THE time was ripe, even before the Seven Years' War actually broke out, for the reorganisation of the Regiment, with its eighteen separate companies and cadet company. These were however increased before any further step was taken. A company of miners which was raised in May 1756 to assist in the effort to retake Minorca, was on its return incorporated into the regiment as a company. In April of the next year four more companies were raised making the total, cadets included, twenty-four companies with a regimental strength of 2,531. The need for reorganisation was emphasised by the disproportionately large number of junior officers with small chance of promotion in a corps which was only allowed four field officers. Further the companies were scattered about over almost the whole world whilst the headquarters of course remained at Woolwich. The change came in 1757. By it the Regiment was divided into two battalions, each with its own colonel, lieutenant-colonel, major, staff, and twelve companies, the miners becoming a company in the first and the cadets in the second battalion. This change marks a very definite stage in the history of the regiment. It was not merely a step desirable in itself both for efficiency as, by increasing the number of field officers, giving greater opportunity for promotion to company officers and so contributing a little to keep them from going over to line regiments where promotion was quicker. With the definite names given to companies—numbers were not used until 1820—we have arrived at a stage when with a little labour we can trace the history of these companies, or most of them, down to our own day, to the batteries—field, mountain, heavy or siege—which can claim the original companies as direct ancestors despite the frequent changes they have suffered in title since their formation. To trace this succession is outside the scope of such a sketch as this. It is the less necessary here since it has already been done.[1] As to the battalions it is hardly necessary to remind the gunner of to-day that they never have been and never

[1] By Duncan, to 1872, by Hime to 1896 (*Mins. Proc. R.A. Inst.*, XIV. 1886 p. 245, and of course partially in many places.

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were intended to be to the artillery what they have been to other regiments. After, as before this reorganisation, advisable as that was at the time, the company remained the unit. Often the companies of a battalion would be scattered over thousands of miles with the battalion headquarters at Woolwich. When the headquarters of the fourth battalion were sent to New York during the American war, the experiment was not particularly successful. And this was of course not from any fault of the battalion staff but from the nature of the arm, and its use in war.

In the first division of the companies all of those abroad save one had been allotted to the second battalion, those at home to the first. The second also had the cadets and was thus one effective company short until in the next year an additional company was given to it. The strength of these battalions as of the companies in them varied considerably during these years and indeed long after. So too there was no rule as to the number of companies a battalion might contain. In 1760 the third battalion was created by taking five companies from the existing two and adding five new ones, giving the new battalion a total strength of 1054. With the peace of 1763 came the natural reduction, this time however not of whole companies or battalions, but of strength, the company establishment being reduced from one hundred and seven to fifty seven all ranks. In 1771 as a measure of peace reorganisation rather than of war the fourth battalion was created. For it two companies were taken from each of the other two and two new companies created, which process left all four battalions with eight companies. An additional but almost shadowy two companies for each were made at the same time from the 'Invalids' to whose earlier history we have referred. The formation of these "Invalid companies" into an "Invalid" battalion, with a further addition of two companies, came as a war measure in 1779, when their place in the other battalions was taken by new companies. This relieved the situation as regards promotion a little. The invalid companies were used primarily for garrison work in Great Britain, but under pressure of war abroad also, two being sent to Newfoundland in 1775. The grievance of promotion, or rather of lack of it, was more satisfactorily dealt with in 1782 by the change in the regimental establishment which introduced a second colonel, lieutenant-colonel, and major for each battalion. This change also reduced the number of company officers by one second-lieutenant, leaving it at the familiar number of five, a captain, a captain-lieutenant, two first and one second-lieutenants, the remainder of the company being left unchanged at four sergts., four corporals, nine bombardiers, eighteen gunners, seventy-three matrosses and two drummers. The Captain-Lieutenant who received army rank as a Captain in 1772, disappeared in 1804 when his place was taken by a second Captain. The lieutenant-fireworker had already gone in 1771 and the matross went at the setting up of the peace establishment in 1783. By the end of the American war the regiment had reached a strength of 5337. This was decreased by 2000 at the Peace of Versailles, though only one company was reduced, the strength of a company being left at sixty-seven all ranks, a reduction of forty.

The making of the battalions was, so far as organisation went,

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the outstanding development of these years, but one or two others must not be forgotten. The recognition in 1757 "that the Engineers are a separate and distinct corps from the artillery", was a natural step which while separating the two corps, did not of course sever the close connection between them. The origin of the Royal Irish Artillery, formed as a separate regiment in 1760 to last until the Union, has been referred to already. With the making of this Regiment its strength was placed at four companies, with a Colonel-in-Chief in command. Reductions followed the peace three years later but war saw the regiment expand again, to six companies with a strength of 534 in 1778. An Invalid company was added in 1783 but reduction following the peace again came hard on its heels, and at three hundred and eighty six strong the Regiment remained for the ten years of peace. Another child of the mother regiment which like the Irish Artillery was to return to its parent, though half a century later than the other, was the artillery of the East India Company. This really dates back to 1747 when the formation of a company of artillery in each of the three Presidencies was ordered, the order being carried into effect next year. A second company was added to the Bengal Artillery in 1758 and a third five years later. The year 1770 saw a battalion of five companies formed, and there for the moment we must leave this branch from the main tree, remarking only that the connection was not quite gone in this period since, at the request of the Company, in 1765 an officer of the home regiment, Major T. D. Pearse, was placed in command of the Bengal corps which had also drawn junior officers and cadets from Woolwich.

In dress, arms and equipment these twenty-seven years saw less change than might have been expected. There were some changes in uniform. The officers first lost the lace from their waistcoats and then, "in 1768 white waistcoats, instead of scarlet, and white breeches were adopted both for officers and men". Swords instead of fusees for the officers and epaulettes instead of laced shoulder knots came two years later, and the sash was moved from over the shoulder to round the waist. Shortly afterwards the accoutrements of the men were changed from buff to white. "The dress for a parade under arms was as follows:—the men in white breeches, white stockings, black half-spatterdashes, and with their hair clubbed: the officers in plain frocks, half-spatterdashes and queues, with white cotton or thread stockings under their spatterdashes and gold button and loop on their plain hats".[1]

To turn to a much more important matter, the guns of the period: in so far as European fighting was concerned, the three pounder was definitely superseded by the six pounder as the 'field' or 'battalion' gun. But the same reasons for which in India the three pounder remained the battalion gun for a much longer period, brought back the three pounder "grasshopper" gun for the American war. The lighter gun lost in fire effect but gained in mobility in fighting where long distances had to be traversed and where roads were bad or non-existent. We did not however go back to the 1½ pounder 'galloper' guns of the previous war; the three pounder is

[1] Duncan, i, 242, 265. Macdonald, plates iv, v and vi.

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the galloper gun of the period. Not that it galloped so fast or so far by modern standards: the one three pounder which set out with Tarleton's 'Legion' of irregular horse on his famous march of one hundred and five miles in fifty five hours over South Carolina trails had unfortunately to be left behind en route. There was no horse artillery yet and what was worse, the drivers were not soldiers. But special efforts were made, and with some success, to make this three pounder both light and mobile in the American war, and the work of the guns at Minden and the performance of Phillip's 'brigade' at Warburg in the preceding war show a definite advance in that respect. A gunner officer's diary of these years has an amusing entry[1] showing the attitude of the infantry towards the mobility of the guns, presumably the much abused 'battalion' guns. These guns, in pairs, each with an officer, two non-commissioned officers and twelve men of the regiment were in use as such throughout this period, the companies on service supplying the detachments much as a battery might supply a section for service with a battalion to-day. Fortunately the attachment though usual was never permanent nor did it as a rule include all the light artillery. There remained room throughout, as the record of operations amply shows, for work by more independent 'brigades' i.e. batteries of light guns as well as by the heavier 'guns of position', which as battles of position were still fought, had an important part in those battles, notably in those of Frederick the Great. While the use of these guns—18, 24 and sometimes 32 pounders with heavy howitzers as well—tended to reduce the mobility of the arm as a whole, efforts were also made to make these weapons lighter and less cumbersome, though with only very modified success. While it is too early to see the results on gun making or gunnery of the Industrial Revolution, the efforts of men like Desaguliers illustrate the growth of the interest in scientific gunnery as does also the foundation of a Military Society at Woolwich in 1772. The use of shell in guns as well as in howitzers in the siege of Gibraltar, the introduction of the tangent scale, the first manufacture of 'carronades' in 1779 may serve as further examples of the gunnery developments of the time in England.[2]

Yet though the reputationof the British artillery stood deservedly high in Europe in and after the Seven Years war some of the most

[1] "I have my reasons for saying that the army are very sparing in their enconiums on the artillery. Many times officers have been heard to say on the march "Go on, go on, never wait for the artillery," but I always observed that when these unsoldier-like words were pronounced, the enemy were at a considerable distance and that no sooner does the popping begin in front than the tune is altered. "Where are the guns, where are the artillery? Halt in front and clear the road for guns" is then the cry." Diary of Lt.-Col. Frances Downman, printed in *Mins. of Proc., R.A. Inst.*, XXV, 1898, p. 496.

[2] Without making any attempt to discuss the history of purely technical developments, the following extract from some gunnery notes of the year 1780, "On the Construction of Batteries," by Major G. Williams, printed in *Mins. Proc., R.A. Inst.*, VI, 1870, p. 455, may be of more general interest. "When possible for drainage sink your platform by throwing earth in front to form your battery. But if it is not possible to drain the battery in this way, make a ditch 12 feet wide in front of the battery and throw the earth back. In any case all batteries should have a ditch 12 feet wide in front (with earth in front) not less than 7 to 8 feet deep, to prevent the enemy by sortie from attacking and spiking your guns. The magazine should be to a flank and not more than six rounds with each gun at a time," etc.

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marked advances in the organisation and use of the arm were appearing elsewhere in Europe. In France Gribeauval's work though begun in 1765 had its results after this period; Austria, credited with the best artillery in the world when the war opened, saw no great changes in it. In Prussia however it was different. Frederick The Great was never a great artillerist and indeed to begin with was not specially interested in the arm. But the battles of Rossbach Zorndorf, Hochkich and Kunersdorf, in the first three years of the war showed clearly in their several ways how valuable an adjunct to victory artillery might be, primarily when massed for offence or defence. Frederick seized the significance of this and increased both the amount of his artillery and its independence of action in battle. To the gunner of to-day however he is best known for another development, as the founder of Horse Artillery. It was in his army that the first serious and successful attempt was made to provide a light artillery mobile enough to act with cavalry. The first battery was formed in 1759 of six pounders and though at first it met with some criticism, royal support maintained it until it could justify itself in the field. That indeed it may be said to have done during the Seven Years' War. It is only fair to recall the fact that light artillery was being used with cavalry in India as early as 1760. In England it was to be a generation before Horse Artillery batteries were formed in 1793 within a few months of their formation in France. Limber boxes had come in before this to assist in solving the question of ammunition supply for a really mobile artillery.

Turning to the operations of these years, the first formal move in the war in Europe was the French attack on Minorca. With a larger regiment, wider experience and more officers of better general education, we find more information from diaries, journals, etc. of R.A. officers, and there remains an interesting diary[1] by an unknown artillery officer who went through the ten weeks siege of Fort St. Philip following on the French arrival in April 1756. The hundred artillerymen who with the aid of two hundred sailors and infantrymen served the guns in the almost continuous night and day firing, inflicted with their 32 pounders far more loss on the besiegers than they in their strong rock fortress suffered from the hundred guns and mortars —some of them 13-inch—with which the French pounded the fort. But there was little hope of rescue, none after Byng's unhappy effort, and the garrison could congratulate itself when on 28th of June it marched out with the honours of war. Recompense for the loss of the fortress can hardly be said to have come in the attacks on the French coast in which the gunners had their share in the next ten years. The first was against Rochefort in the year following, an even more than usually futile example of such attacks, in which one company of the regiment took part, and another came in 1758 against St. Malo when with a force of sixteen battalions went four companies with sixty guns—from 24 to 6 pounders—and mortars and howitzers. This expedition likewise achieved no result proportionate to the effort expended, returning after demonstrations at various places on the coast between St. Malo and Cherbourg. A third effort though it began more promisingly with a successful attack

[1] Printed in *Mins. Proc., R.A. Inst.*, XX, 1893, p. 535.

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on Cherbourg, ended more disastrously with a loss of more than fifteen hundred men; a parade of captured cannon through the streets of London was dear at the price. The last of these enterprises during this war was that against Belle Isle in April 1761. Three companies of artillery with a good deal of heavy ordnance and detachments for the bomb ships and the battalions took part under Colonel Desaguliers. After delays due to bad weather and the difficulties of securing a landing place on the strongly fortified island, the heavy guns and mortars were landed and set up, reducing in turn the outer and inner defences on which over ninety pieces played until after five weeks of siege the place surrendered, to be held until the peace when it was exchanged for Minorca.[1]

More serious, though without the seriousness of the earlier Flanders campaigns, was the British effort in Germany. There with the double task of guarding Hanover and of protecting the right flank of Frederick of Prussia, Ferdinand of Brunswick had command of a force which while not nearly equal in numbers to the French threatening it from the Rhine and the Main, was yet as events proved sufficient for the purpose. It included by 1759 ten thousand British troops of all three arms, the artillery, of little over a company in 1758, being increased in the following spring by a company and a half. Though the battalion guns, definitely light 6 pounder guns now, remained, the rest of the guns, light 12 and 6 pounders and howitzers, were divided into 'brigades' of mixed calibre, a clear step forward which was more than justified by the immediate results. For while Minden resembles Fontency in being an example, though a happier one, of the prowess of the British infantry in attack, the share of the British artillery in the allied victory that day was greater and shows a definite advance over its part in any previous battle in which it had been employed. Lack of space forbide and detailed account of the battle or indeed of the work of Captains Phillips, McBean, Foy and Drummond. It is probably true that the failure to use the cavalry gave a greater rôle to the artillery but it is to the credit of the gunners that they took the opportunity and made the most of it, earning the unqualified praise of Prince Ferdinand himself as of other less official observers. Minden was not a battle of prepared positions. The French in the hours before dawn on the 1st August, 1759, crossed the Bastau brook and the Weser which met at right angles at Minden and established themselves or set about establishing themselves in front of the town in a straggling arc, convex side to the enemy. The allies advanced covering a wider and even more straggling arc from the British on the right to Wangenheim's corps on the left, so soon as word arrived of the French advance into the plain of Minden. The French were superior in numbers, the allies had a few more guns, 170 to 162, though neither side had all their guns in action. The battle was virtually won by the audacious attack of the British infantry on the great mass of the French cavalry in the centre, protected though it was by the fire of thirty guns on either flank. The British guns gave considerable assistance by beating down the fire of the left of these batteries with ten 12 pounders. The success of this attack, supported by

[1] Duncan has a chapter on this siege. Vol. I, XXI.

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further attack on the left practically won the battle and ten o'clock in the morning the whole French army was recrossing in haste the bridges over the Bastau. It lay with the artillery to turn the retreat across the stream into a rout and prevent the enemy reforming on the other side where their camp lay. Foy and McBean worked their guns along the edge of the marsh, using them on the retreating masses and finally from positions in front of the bridges did not a little to drive the enemy through their camp and over the hills to the south, leaving all their baggage and over forty guns. It was not merely the best example up to that time of the use by the British of field guns, but it showed, or shows to us to-day, that these field guns could be best employed to cover the deployment and attack of troops and to follow up that attack, when collected in groups under their own officers.

The following year enhanced still further the good repute of the Regiment on the continent. With the reinforcements sent to Germany in the early summer of that year went two additional companies of artillery. In the action of July 31st at Warburg, when Prince Ferdinand's infantry were unable to reach the battlefield in time to support by frontal attack the action already begun against the French left and rear, the artillery, for the nonce horse artillery, went on with the cavalry as they trotted the last miles to the attack. Then when their charge on the French right was being pressed home, supported by the flanking attack on the left, one 'brigade' commanded by Phillips, doubtless with the cavalry charge in sight and mind, galloped their guns to the edge of the river Diemel over and through which the French were now pouring, and with their fire helped to bring them to a state of confusion that sent them far past the southern bank without hope of rallying. The gunners had earned, and received, the praise of observers. We must pass over the marchings and counter marchings, sieges and battles, to say nothing of the more numerous lesser encounters, of the last two years of the war in this field. The largest engagements were indecisive and it must suffice to say that whilst we do not read of any further spectacular work done by the artillery, it at any rate retained the reputation already won.

So far as Great Britain was concerned however, it was not in Europe that the war was won, but further afield, in North America, in India, in the West Indies. The first essay of the Regiment in this last field, the expedition of 1741, had been anything but happy. Those of the Seven Years' War were more successful, though costly, rather from disease than from battle. Operations there were first directed against the small French islands but with the formal outbreak of war with Spain in 1761 came operations against Cuba also. Though artillery accompanied all these expeditions—one company which helped to capture Guadeloupe in 1759 helping to garrison it afterwards, two companies going with the expedition against Martinique and St. Lucia in 1761 and nearly three companies against Havana in the next year—the amphibious nature of the fighting makes it difficult, in fact impossible, to distinguish between the land and sea work of the guns: and naval operations are entirely beyond our scope. All the islands were fortified more or less strongly and

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though differing of course in detail the fighting was of the same type in each case. It involved a possibly disputed landing as near to the principal fortress as was possible, the approach within range of that fortress, sometimes by stages with siege operations at each stage, the battering of the fortress until storming appeared practicable, and then the final attack or attacks, unless surrender made that unnecessary. There was thus obvious need for and use of artillery, in fact without it such attempts would have been futile. And of course all such attempts depended on the command of the sea. The operations in Guadeloupe in 1759 gave more protracted fighting all over the island, of the artillery's share in which the Journal of Francis Downman, then a subaltern of seventeen, who served through it under Colonel Cleaveland, gives us a sufficiently good picture.[1] Its record of more marching under difficult conditions than of actual fighting will fit a good many similar expeditions. The most profitable for the prize it brought as the most costly from the lives lost from disease was the Havana enterprise where for nearly two months siege operations went on with an ever increasing number of guns and mortars of all calibres, first against Fort Moro the main covering fort of the town, and lastly when that and Fort Puntal had with considerable toil and difficulty been reduced by mines and storming, against the town, which speedily surrendered.[2]

On the continent of North America the early experiences of the regiment, notably that with Braddock the year before the war formally broke out, had been almost as discouraging as those in the West Indies. And its share in the great event of these years there, the conquest of Canada, was not so outstanding. This was primarily due to the natural difficulties to movement encountered by any force operating within the country, whether north towards Lake Champlain, or north-west towards Lake Ontario, or further west toward the Ohio. "Never", says Parkman,[3] who had travelled the country "was the problem of moving troops encumbered by artillery and baggage a more difficult one." In fact after reading the story of the conflict from 1755 to the capture of Montreal five years later one is rather amazed at the places to which artillery was carried and at which it was used

[1] *Mins. of Proc. R.A. Inst.*, XXV, 1898, p. 1, *seq.* The Journal covers fighting in the American war also. The following extract will serve for the Guadeloupe operations. "It is not easily conceived what hardships and difficulties the troops have gone through that were employed on this service, viz., the want of provisions, the crossing of rivers, climbing of precipices, lying on the bare ground in wet clothes, excessve heat of the climate, and many other things which sufficiently show the goodness and bravery of our troops and the skill and perseverance of our leaders. For my own part I believe I fared as badly as any soldier in the army. Very often indeed have I been obliged to be content with a small piece of salt pork or beef and a biscuit and draught of water. Fresh meat on the march was the greatest rarity. I did not from the day of my landing until I returned to Petit Bourg (over one month) but once lie upon a bed. Every night my matress was the bare ground or the leaves of the sugar cane, and yet notwithstanding I never had the smallest illness, though others were attacked with many disorders. . . . During these operations we took 45 pieces of artillery which had they been defended with any spirit must have done great damage to our army."

[2] Browne, England's Artillerymen, p. 29, quotes Albermarle's despatch as follows:—"The guns and mortars were so well served by the artillery and sailors and their effect so great that in less than six hours all the guns in the fort and north bastion were silenced."

[3] Fortescue, ii, 409.

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than disappointed at any lack in its employment. There was one case where it could have been used with effect and where it was on the spot or nearly so but was not employed, viz. Abercromby's attempt against Ticonderoga in 1758. But that was no fault of the gunners. Elsewhere its increasing use as the operations developed is shown well enough by the fact that whilst before the war, excluding Braddock's artillerymen, there were only two companies of gunners in North America, by its close there were no less than ten companies there. It was 1758 before with the stimulus of Pitt's genius the tide of British endeavour in North America turned from ebb to flow. So far as purely artillery work was concerned the largest operation of the war came in that year in the siege and capture of Louisburg. For this the reinforced remnants of Captain Ord's company were increased in two companies which sailed from England with the main force, the whole of the artillery, 324 all ranks, being under Colonel Williamson. There were over one hundred guns from 32 pounders down to one solitary 3 pounder, more than half of them being 24 pounders; also forty four mortars from 13 inch to 4½ inch, and a few howitzers. To these and the fire of the ships the fortress could oppose the fire of over two hundred pieces of ordnance though it was insufficiently supplied with ammunition. For the details of the siege the reader must be referred elsewhere.[1] As the command of the sea was assured, once the difficulties of landing—fog, rough sea and French opposition—had been surmounted, the result of the siege from 19th June when the first batteries opened, to the surrender on 27th July, though far from uneventful and indeed full of difficulty, was not very much in doubt. It cost 18,000 rounds of ammunition and over 500 casualties. Thus one of the gates into Canada was secured. The three other efforts of this year, that of Abercromby against Ticonderoga, of Bradstreet against Fort Frontenac and of Forbes against Fort Duquesne, saw no artillery in action though Abercromby took with him a not inconsiderable number of guns.

The grand climacteric of this fighting came of course in the next year with Wolfe's successful attempt on Quebec. Though a number of gunners were left behind in Louisburg, reinforcements came from England with Wolfe which more than made up the strength of the companies there. In the eleven weary weeks between the arrival of Wolfe's force below Quebec and the famous fight on the Plains of Abraham, guns were planted both across the Montmorenci to enfilade Montcalm's entrenched camp from its left and across the St. Lawrence at Point Lévis whence they could fire into Quebec itself. But neither of these positions brought Wolfe much nearer the possession of the city and the very nature of the operation precluded any serious share by guns or gunners. It was a difficult enough task to get 4,500 men up the broken path that led to the heights above Quebec in the darkness. One light gun and ammunition they did contrive to get up before dawn on that September morning and it was planted on the road which ran from Quebec through the middle of the position taken up

[1] Duncan has a chapter on the siege; see also Fortescue, ii, 322 seq. the proportions of ammunition expended are of interest:—13,700 round shot, 3,340 shells 766 case, 156 round shot fixed, 50 carcasses.

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by Wolfe's force, a second gun being apparently dragged up during the action. Fortunately for the British, Montcalm in his haste to give battle was able to collect only three field guns from Quebec, all his own artillery being on the far side of the city, and against them and his troops the single gun of the British, from all accounts, did excellent work, more than repaying the toil by which it had been placed in position. Later the two guns helped materially to throw back the threatened attack from Bougainville in rear when Montcalm's force had fled in disorder into and through Quebec. In the meantime whilst Wolfe was tightening the noose about that city, Prideaux had worked his way across from Albany by the Mohawk river to Lake Ontario and along the lake to Fort Niagara where in July batteries were set up and the lake and gorge echoed to the sound of British guns for the first time, the fort being reduced on the 24th July. Just three days earlier Amherst's own force of 11,500 men, including about a company of artillery under Major Ord, had set sail up Lake George for another attempt against Ticonderoga. Now as in the preceding year however the guns were not used, not this time because they were not brought up against the fort but because the French abandoned it, as they did Crown Point higher up the lake.

Artillery played some part in the defence of what had been gained in this year of triumph 1759. In the fight of St. Foy in April 1760 for the defence of Quebec, Murray's twenty battalion guns and four howitzers helped to give him a superiority over the French which but for his own rashness might have been decisive. As it was the guns were fought so long as ammunition lasted but then, immobile in the snow and slush of the battlefield, had to be abandoned in the retreat inside the walls of Quebec where the 'field' gunners of the battle at once became 'siege' gunners, to assist in the defence of the city. However on the French retreat a fortnight later they both recovered their own guns and captured some abandoned in turn by the French general Levis in his retreat. In the final scene of the drama of the conquest of Canada there was not much occasion for artillery work. Of the three forces which moved on Montreal, Amherst coming from the west had used his guns against Fort Levis on his way east from Lake Ontario, Haviland had similarly used his to reduce Ile aux Noix coming up from the south, and Murray brought artillery from Quebec. But there was no siege of Montreal; the odds in men were too great and on 8th September 1760, Canada became a British possession.

Though the war did not end then it must be left with that. With the exception of its course in India enough has been said to indicate the occasions and the manner of the use of artillery in it. We have already referred to the domestic changes in the regiment during the period of peace, and its general history may be sufficiently indicated by Duncan's summary,[1] "From 1763 to 1771 was a singularly uneventful period in the history of the Regiment. One battalion was quartered in America, its headquarters being at Woolwich; the companies of another were divided between Gibraltar and Minorca, and the third was in Great Britain. The companies in the East Indies remained as before until 1765". Reliefs were regularised, which was the more necessary since the number of places to be

[1] Vol. i, p. 241.

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garrisoned had grown considerably, there being no less than twelve in North America. The recently formed fourth battalion went there in 1773 in relief of the companies there then.

The war which began in 1775 and ended by the Peace of Versailles in 1783 was of course primarily and mainly the revolt of the American colonies against the mother country. But in 1778 France came in against Britain and in the following year Spain. Whilst the entry of these two European powers or that of Holland in 1780 did not involve us in general fighting in Europe, it was inevitable that since Spain had entered the war to recover her lost possessions, she should make efforts against Minorca and Gibraltar, as in the West Indies. Of the three companies of artillery who served in Port Mahon during its siege from August 1781 to its capitulation in February of the next year, Murray who was in command, said in his report, "I believe the world cannot produce more expert gunners and bombardiers than those who served in the siege", one hundred and seventy of whom marched out at the capitulation. As frequently happened at this period, there were more guns than there were gunners to man them. The whole garrison was indeed too small for the defence of the place and sickness took more than the fire of the fifteen batteries set up by the French and Spanish. The extracts printed from an artillery officer's diary of the siege give a fairly clear picture of the work of the garrison, over matched and over wrought.

The fall of Port Mahon released the large French and Spanish forces under the Duke of Crillon for a more famous siege which had indeed been going on since the summer of 1779, that of Gibraltar. This was not merely the greatest siege of the century but it was in some ways the greatest defensive operation in which British artillery has ever engaged. Even the siege like operations of the late war on the west front did not call on men to endure their weight in the same spot continuously without relief. Yet the five companies of the regiment, 485 men all told, who in June 1779 heard the first shot fired, were penned up in the fortress for over three and a half years. Reinforcements for the garrison and supplies came through to the besieged it is true but neither could bring relief from the besiegers' fire. The siege passed through several stages. The blockade began in the summer of 1779 and slowly tightened into a formal siege as the Spaniards in the autumn of 1780 set up their batteries across the Isthmus, which came to hold one hundred and thirty five pieces of heavy ordnance, a piece every ten yards had they been in in one line across the position. The number of pieces was later increased to two hundred. It was on the 12th April 1781 that the bombardment broke out that was to continue without a break for a year and a half ere after reaching a crescendo of fury on 13th September 1782, it gradually slackened down to close with the opening of peace overtures next February. To the land force of 40,000 men and their 200 pieces of artillery were added, in the critical attack, "ten battering-ships, deemed perfect in design, and esteemed invincible, carrying 212 guns; besides innumerable frigates, xebeques, bombketches, cutters, gun and mortar-boats, and smaller craft for

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disembarking men".[1] To oppose all this the besieged had 452 guns from 38 to 3 pounders, 70 mortars from 13 inch downwards, and 28 howitzers. It was not ordnance but men to work them that were needed. The daily routine of duties took, it was estimated, over 2,000 men and as the siege went the toll of battle together with the increasingly heavy losses from sickness more than nullified the reinforcements which had come earlier.

The long bombardment during which the town itself was completely destroyed, was naturally not received without reply. General Eliott, the Governor, was unceasing in his efforts in this as to maintain the health and spirits of the garrison. The artillery commanders, Colonel Tovey and after his death Colonel Williams, were no less zealous. In November 1781 a most successful sortie was made by over two thousand men, including 114 gunners, some with each of the several columns to assist in the destruction of the batteries and make sure the guns were spiked properly. The besieged were fairly caught and a large part of the work of a twelvemonth, batteries, guns, mortars and magazines, were destroyed, and that at the smallest cost to the besiegers. Less purely offensive measures of artillery interest were the hewing out of the gun chambers in the solid rock, the invention of a carriage from which guns could be fired at depression up, or rather down, to 70°(2) and the increased use of shells which were there first fired successfully from guns as well as from mortars in order to secure a greater range than the mortars could give. This last however was to some extent lessened by the success of red hot shot both against the land batteries and, of more account, against the floating batteries brought up by the besiegers and relied on as immune from shot or shell fire. The day of 13th Sept. 1782, the most arduous as well as the most glorious for the garrison, proved that they were not. Drinkwater, the historian of the siege, puts the disproportion of artillery that day at more than three to one in favour of the besiegers. The attack failed and the gunners had good reason to feel well pleased with their day's work when at its close they were relieved at their guns by sailors. That night the bay was lit by the conflagration of the 'indestructible' battering ships, the rock shaken with their explosion. After this failure though bombardment and reply continued, it was in decreasing measure and the last shot was fired early in February 1783. It is entirely beyond the scope of this sketch to bring out adequately the magnitude or importance of this famous siege. It was one the garrison gunner of to-day at least may well remember.

The military operations of this war in the West Indies need not delay us. They included the siege and capture of Omoa on Honduras bay, the expedition to Lake Nicaragua and the taking of Fort St. Juan, so nearly fatal to the young Nelson and the fighting on St. Kitts. Though they lack neither interest nor a certain importance, in them all, more obviously if not more surely than elsewhere, sea power was the decisive factor in the situation and the land operations tended to be very directly subsidiary to that. The same was to a con-

[1] Drinkwater, qu. Duncan, i, 285.

(2) There is an account of this in "Mins. Proc. R.A. Inst.," XXXII, 1905-06, p. 483, and of the use of shells in guns in Hime, "The Origin of Artillery."

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siderable extent true of the war on the mainland, most clearly so in its final stages. In some of the naval operations on the coast and up the rivers bomb ships with gunner detachments were used, and artillerymen on one or two occasions served the guns on the 'gun-boats' of the period there, as seamen acted as gunners ashore. The artillery still retained, and could still use the motto 'per mare per terrain'. With regard to the land operations it is difficult in a short space to deal with the work and place of the artillery in a war which went on for more than five years with fighting over almost the whole of eastern North America. From New York to Lake Ontario, from Quebec to Pensacola we find companies or detachments of gunners fighting first American colonists then French and Spanish when these came into the war. And not merely did the fighting take place over an immense area but so much of it was of the nature of 'guerilla' fighting that any consecutive or detailed account is out of the question. There were no pitched battles between large forces, no great displays of massed artillery, no heavy or prolonged bombardments before or during a battle. For the long and difficult marches which made up much of the war light guns were used. Heavy guns had to be transported by sea as far as possible, for example from New York to the Chesapeake by Howe in 1777. The 3-pounder 'grasshopper', practically superseded in Europe, came in again almost at once and was used throughout the war. The light 6-pounder was frequently used and, less often in the field, the light or medium 12-pounder howitzers were likewise employed. Thus at Bunkers Hill the British had four light 12 and four light 6-pounders and four 5½ inch howitzers, though four guns, probably the 12-pounders, were not used. At Brooklyn on 27th August 1776 to some 25,000 men Howe had about forty guns, four of them 12, the rest 6 and 3-pounders; the army captured six light and twenty six heavy guns there. At Brandywine a year later they had ten 12-pounders, 4 howitzers and 'battalion' guns, 6 or 3-pounders. Burgoyne's guns were probably all light. In the later engagements in the southern fighting Camden, Cowpens and Guildford, only a few 6 and 3-pounders took part on either side. For the siege of Charleston Clinton had 24 and 18-pounders in addition to lighter guns, and guns of this size with mortars of varying calibre were mounted in practically all the places held by the British during the war, Boston, Rhode Island, New York and the adjacent forts, to Yorktown where they were overwhelmed by the heavier fire of the combined French and American guns at ranges from 600 to 300 yards in the siege.

At the outbreak of war the British naturally had a considerable advantage in the number of guns and trained gunners. From the nature of the fighting this was not so great an advantage as it would have been in Europe, and as the war went on the colonists received supplies of guns from France, Spain and Holland; they also captured a number as at Ticonderoga though they may not have got those away. As to artillerymen even on the British side the demand increased faster than the supply. "The demand for artillerymen is so great", wrote Colonel Cleveland who was in command of the artillery for a time, "that the smallest body of infantry wish not to be without them. I must therefore entreat your Lordship to give us

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every possible addition to our corps". Beyond casualties which were fairly high in proportion to numbers, there was a special cause for the loss of officers to the corps in the attraction of speedier promotion offered them in the line regiments. Such transfers were forbidden in 1779 and cadets on active service were given the rank of second lieutenant in the same year. To the companies of the fourth battalion in America at the outbreak of the war were added in the next year companies of the third and first battalions, and men of the Irish artillery were likewise sent across the Atlantic, some of them sharing in the perils and fate of Burgoyne's force. In 1779 there were 16 companies, exactly half the regiment, serving in America.

Without any attempt at glorification it may be said that the good name of the artillery was more than maintained during this war. Whether in victory or defeat and more rather than less as the war went on, the gunners were commended for their work. Almost the only criticism of it came at the beginning, the charge that ammunition of the wrong calibre was sent with the guns to the engagement of Bunker's Hill, and that is vigorously disputed; the guns were certainly used at the beginning of the action. And the commendation, then as always, was not merely of the commanding officers whose names are well known in the history of the regiment—Cleveland, Pattison who succeeded him in the command of the fourth battalion there, Phillips who held the local rank of Major General, James, Innes, Downman and others—or subalterns such as McLeod who earned the special praise of General Cornwallis, but of the whole family of gunners fighting there.[1] It is only possible here to choose examples somewhat arbitrarily to illustrate the work of the artillery in the war. Burgoyne's expedition, disastrous as it was can hardly be overlooked. With his force of 7,000 men Burgoyne took four companies of artillery under General Phillips, one of the most outstanding gunner officers of his time whom we have already seen in the earlier war in Europe. It was largely due to his eye for a position in choosing a commanding place for his guns that the fortress of Ticonderoga was captured so easily. Advancing slowly, clearing a way for his guns and baggage, Burgoyne reached and began to descend the Hudson river. In the abortive attempt to surprise Bennington four guns were lost. But at Stillwater or Bemis Heights the artillerymen covered themselves with glory. With Burgoyne's thousand regulars holding the centre of the British line in the attack and heavily pressed by the colonists under Arnold, was a 'brigade' of four guns with forty-eight artillerymen. They supported the attack gallantly, being, as Phillip's report said "particularly engaged", so particularly indeed that but five out of the forty eight escaped being either killed or wounded. These five with their guns and the remnant of the infantry were only saved by the arrival of Phillips himself, who had struggled through the woods from the left with four more guns, and the men of Riedesel's column. At Burgoyne's next and last encounter on 7th October, with greater odds against him, the story was much the same. True this time the six guns under

[1] There are notices of these officers in Duncan and Kane's *List*, and scattered through the volumes of the *Mins. of Proc. R.A. Inst.*, eq. xiii, 189 seq., xxv, 1 seq., xxxi, 13q; also in Browne, England's Artillerymen.

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Major Williams were captured by the enemy along with their commander, but only when "the artillery horses were all destroyed and his men either killed or wounded". After the disastrous Convention, Phillips was later exchanged, and some of the gunners succeeded in escaping to New York when the terms of the convention were broken.

We find a parallel to Bemis Heights over three years later at Cowpens in South Carolina where the fighting had moved by this time. There Tarleton's "Legion" of horse was defeated by Morgan with the loss of his two 3-pounders. "No terror" says the despatch, "could induce the artillerymen to abandon their guns, and they were all killed or wounded in their defence of them".[1] Some compensation for this loss came exactly two months later when at the battle of Guildford in North Carolina not only did Cornwallis' three guns give an excellent account of themselves but the four American guns were taken. These were of course hardly battles but rather skirmishes, hardly comparable with earlier much less with later European battles in magnitude. Nor do the sieges of the war, of Boston by Washington, of Charleston by Clinton, of the Hudson forts by Howe, of Yorkton by the combined French and American forces, or of Pensacola by the Spanish, compare with the siege going on at the same time, that of Gibraltar, in length or severity. Nor are there any outstanding events to make them so notable that we can find space to tell of them. The defence of Quebec in the first year of the war probably merits as much attention as any of them, and that was hardly a major operation.

The word "*Ubique*" has been placed at the head of this chapter although the badge was not used by the regiment until 1834. It might however have been claimed before the end of the Seven Years' war. For in addition to the enterprises already mentioned, wide as was their zone, artillerymen had a share in others which took them as far and further afield in other directions, giving to the gunner of the eighteenth century a ubiquity which the men of few if any other regiments could claim. We have omitted as lacking in military importance the fighting in the Peninsula in 1762 when after Spain had invaded Britain's ally Portugal, a force of 7,000 men was sent to the assistance of the invaded country. Some officers, artillerymen as others, were also loaned to the Portuguese army. In one of the few and little remembered actions there Major McBean with a battery of four light guns, did excellent service as rear guard artillery with the cavalry under Burgoyne. Looking further afield, whilst British expansion in Africa is mainly a nineteenth century development, the rivalry of French and English merchants on the west coast caused an expedition to be sent there from England in 1758. With the first tiny force of 200 marines went twenty-five artillerymen for the capture of Senegal. Nor can we stop at Africa. The most

[1] Fortescue's account, iii, 368, is worth quoting from in this connection:— "Not a fraction of Tarleton's force shewed a front except a tiny handful of British artillerymen who stuck indomitably to their two three-pounders, and the solitary troop of the Seventeenth Light Dragoons, which had rallied from its first repulse by Washington's Horse. At the head of this troop, now reduced to forty soldiers, Tarleton and a dozen mounted officers charged forward to extricate the artillery, but too late to save either the guns or the gunners, who had fallen almost to a man."

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distant enterprise of the war was the expedition led by General Draper against Manila in 1762. With him went one company of Royal Artillery. After considerable trouble the artillery was landed and two batteries set up, one of 24 pounders and the other of 13 and 10-inch howitzers. Four hours of firing from them, with the help of the ships' guns, was sufficient to silence the Spanish guns, considerably inferior in number, and two days later the fort was stormed and Manila became British, to be returned at the peace next year.

The part played by artillery in the defeat of the French in India and the spread of British dominion there cannot be dismissed in this summary fashion. It would indeed require a chapter to itself, for in the almost continuous fighting of one sort or another there the share of the guns was far from negligible and their position as a necessary factor in military operations were established. So well established indeed that as we have seen, the Company had its own artillery, and though some companies of the home regiment served in India during these years, none were sent there for a century after 1756 when the last of four companies sailed for that country. It would be unjust as well as unreasonable to record the work of these artillerymen at Plassey and elsewhere save as part of a general account of the part played by artillery in India as a whole. And for that space is lacking here. We must be content to leave the regiment as it was scattered abroad through the kingdom and Empire in the calm that followed the peace of 1783. At that time the first battalion had six companies at Gibraltar and four in the West Indies; the second was wholly at Woolwich where new barracks had been built in 1779; the third was half at Woolwich, the rest at Portsmouth, Plymouth, the Tower and Chatham; the fourth had three companies in Jamaica, four in Canada, two at Halifax, and one in Newfoundland; the Invalid battalion helped to garrison the Channel Islands, Scotland and Newcastle.

(To be continued).

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THE HEAVY BRIGADE AFTER THE WAR.

By Lieut.-Col. C. F. Phipps, D.S.O., R.G.A.

IN the May number of the Journal, Major Forbes discusses the question of mechanical versus horse transport for medium artillery. He suggests that the remedy for the shortcomings of the present system of mechanical transport is to improve gun carriages so that they can move at a higher speed. Yes, most certainly; and his quotations from my article show clearly that I was advocating the use of horses as a temporary arrangement, pending the introduction of a satisfactory tractor.

My second postulate was as follows:—"We mean by a better tractor one which will take guns over rough or soft ground, will enable a battery to march as a complete unit with infantry, will draw ammunition as well as guns, so as to provide for the replacement of gun tractors which may be put out of action, and will be capable, if possible, of accelerated speed, in order to move batteries more quickly from one part of the front to another."

Naturally it follows that gun carriages will have to be improved in order to get the greater speed. But when Major Forbes talks of a horse-drawn battery being "condemned to foot pace", I think that he and I are at cross purposes as to what we each call "moving warfare."

I take it that there are two natures of moving warfare:—

(A). The initial phase of a campaign, when a force has left its base, effected its concentration, and is moving from rail-head to look for, and to deal with, the enemy.

Under such circumstances a Division marches its 15 miles or so per day with the ordinary protective measures, its advanced guard, main body and so on, and with its artillery distributed throughout the column in accordance with the needs of the situation. The artillery is naturally "condemned to foot pace". Whatever the speed capacity of your transport, you cannot scorch along ahead of the advanced guard into the blue!

Nor do you desire to be left behind till sent for. You want to be with your infantry, ready to take any action which may be required.

My contention is that *just at present* it is easier to do this with horses in the guns and firing battery wagons, than with F.W.Ds. and lorries.

But at the same time I look forward to a future tractor which will do this job and *also* will be able to move rapidly at times.

For instance, in the pursuit, the cavalry would love and adore a fast moving 6″ How. battery which accompanied them. Yet even then the battery would be normally "condemned to foot pace" or rather the pace of the horse at a walk, for it would undoubtedly march with the cavalry brigade (or division) H.Q. And our horse drawn batteries can do this.

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Take the first few months of the late war. What more tremendous test can you imagine for the heavy draught horses of the divisional 60-pr. batteries? Yet they came through it splendidly. On the return marches from the Marne to the Aisne, batteries could still trot past the infantry to get into action. That is, after doing about 200 miles in 14 days.

I recall three dates on which F.W.Ds. and lorries would have brought disaster on my battery, and I am profoundly thankful that I had horses—the 26th August, the 27th August, and the 13th September. On one of these dates it was a question of bringing the guns out of action in a soft field and away on a congested road with *no* time to spare; on another of man-handling guns along a muddy track which no self-respecting F.W.D. would have looked at; on another of reversing the whole battery quickly by moving off the road on to a wet field and turning.

And, as regards the transport for officers and battery staff, it is in this nature of moving warfare that you want to be able to reconnoitre quickly over considerable stretches of country, to choose positions and O.P's. and to establish communication. Without horses, you will have to do a terrible amount of walking, after you have got as far as you can with cars and motor bykes.

What happens? Your battery is marching with the main body; your Brigade Commander is with the Advanced Guard; he sends for you to come on quickly, and gives you a task. You proceed to reconnoitre for gun position and O.P.; your battery continues to move along the road all the time and you have to get it to the right place after you have chosen the latter, to have some sort of communication established from O.P. to battery and to keep touch with your Brigade Commander, and with the infantry.

Major Forbes will agree that you cannot do all this with one car and a motor byke! However, the latest provisional establishment now allows 5 chargers and 10 riding horses to each M.T. battery.

(B). A different phase of moving warfare occurs when a successful attack has been made on an enemy position, and artillery moves up to help exploit the success. In this case our infantry is already deployed over the front, there is some sort of "front line." Our 1918 offensive can be considered as moving warfare of this nature.

The Battery Commander's reconnaissance is easier than in (A). He knows exactly where his battery is, in the position from which it has been, or still is, firing; it will not move till he sends back for it. The advance is a comparatively short one. He is already pretty certain about which road he is going to use and has a good idea of the whereabouts of his new O.P.; has in fact been studying the country in front for some hours or some days before the attack takes place.

One can understand his being able to do with less transport for the battery staff than in case (A). But even so I feel sure he would rather have something more than one car and one byke, particularly if the roads are much done in. However, I claimed in my article, and still claim, that our siege battery commanders showed great skill and energy in the offensive of 1918.

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And then of course there is the danger, to which Major Forbes alludes, that the car may not be there! I sympathise with him most heartily. Once we had to supply cars for a month to an Artillery School and we made the chauffeurs keep a diary of what they did there. I try to forget those diaries.

As for transport for guns in this phase, it is worth remembering that when the enemy went back to the Hindenburg line in the Spring of 1917, the roads were very much done in and in some parts of the line, at all events, M.T. guns could not advance at all, while the 60-pdrs. could and did.

But in reality the question of transport, though important, is one of detail, so long as we have the Will to Move.

The fundamental question is:—Are medium guns and howitzers to be put in at the very beginning of a war, or are they to be regarded as a reserve to be brought in if light artillery proves insufficiently effective?

Is the motto of the R.G.A. to be, "Frappez vite et frappez fort", or "Frappez fort mais frappez tard!"

If the former, then one may be forgiven for viewing with concern the proposal to maintain medium and mountain batteries in fortresses, which batteries will not join the field army till it is clear that their services will not be required in fixed defences.

This certainly constitutes a reserve of artillery, but surely a reserve of artillery should be present with the field army and not away at the seaside, when battle is first joined? And is it really possible to train medium and mountain batteries in coast fortresses? Coast Defence is an absorbing and an exacting science; the coast gunner is a fine man at his own work. But his whole outlook on life is necessarily different from that of a mobile gunner. What time can he spare for land practice camps or for manœuvres, without which he cannot learn mobility, march discipline, or co-operation with infantry? Coast Defence is the one branch of the Regiment which gained from the division which took place twenty years ago, because it gave officers the chance of specializing at their own job instead of being overwhelmed with a shifting population from the mounted branches.

In the interests of Coast Defence and in the interests of the Artillery of the Field Army, is the Clean Cut the right policy.

The argument appears to me to be as follows:—

In the case of future wars, we want at all costs to avoid a long war. A long war ruins both victors and vanquished. The war of attrition is a counsel of despair.

But "trench", or "siege", warfare, as we have had it in the late war, results in a war of attrition.

Therefore we want to prevent "siege" conditions from taking place.

The best means of preventing them is to strike heavy blows with our full strength at the very beginning of a war.

This in turn demands that our regular mobile heavy artillery should be present with the field army, in a high state of efficiency, at the very beginning. If it comes later, it will come too late.

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A PLEA FOR THE "COOKER."

By Captain C. A. Jardine, D.S.O., M.C., R.F.A.

"An Army moves on its stomach." This and the well known axiom "The moral is to the physical as three is to one" furnishes the text of the plea which I now put forward in favour of the issue of a "cooker" to Artillery. Constant pressure is the only means by which we can make good our need.

In the R.A. Journal there are frequent articles on the improvement of gunnery and of guns, but few on the subject of moral. I submit that moral and the cooker are very closely allied. And if, as we are led to believe, trench warfare is a thing of the past, our need for the "cooker" will be more marked. The gunner's stomach is not given sufficient consideration.

Let us consider the normal routine carried out by a battery on the march and then let us compare it with the procedure were a "cooker" available. During the war if there were an hours halt the men, might get a mess tin of tea, provided the battery had brisk cooks. An enterprising battery commander, when about 4 miles from billets might surreptitiously send on ahead his cook's cart and cooks, risking a stern rebuke from the Staff and the very real possibility of the driver losing his way. More often the cook's cart arrived with the battery. My experience was that it took one hour to get tea for the battery and two hours to cook hot dinners. Horses on arrival were watered, rubbed down and fed. Whilst the horses fed the men hung about wearily or rubbed over their harness. Stables then started, listlessly carried out by tired men having, literally and figuratively, no stomach for their work. Sometimes I have known men go to bed when the work was done rather than wait for the dinner that refused to cook on a fire hastily improvised. But how much better would be the procedure with a cooker! During a ten minutes halt on the march hot tea: on arrival water, rub down and feed the horses: on turning out a hot dinner all ready and then stables by men restored by their food and rest.

In the final pursuit of the Austrian in Italy my battery, in common with most others, captured a very excellent Austrian cooker with ponies complete. For three days the gunner marched in luxury and received tea during the frequent halts. At the end of the day's march his dinner was ready for him. The cooks would have volunteered for another two years of war. Within three days our hopes were shattered by an order to park the cookers at a specified

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place. Staff officers were detailed to see that these orders were carried out. After the Armistice the cookers marched two days ahead of us for three weeks. I have never been able to understand the reason for this order which to the Regimental officer seemed quite unnecessary and caused a tremendous amount of feeling amongst all ranks. During the war the answer to this plea was that there were only enough cookers for the infantry. Surely now there must be thousands parked all over the country, rusting in disuse! Even if a battery does take up another 20 yards on the road this is outweighed a hundredfold by the increase of moral. And after all, during the recent war, the greatest war of all time, what unit, did not have its unofficial vehicles, taking up a good deal more than 20 yards.

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SOME EPISODES DURING BATTLE-FIGHTING ON THE WESTERN FRONT.

Continued from the September number of "The Journal."
Communicated by
MAJOR-GENL. SIR H. C. C. UNIACKE, K.C.M.G., C.B.

XXXIV. An instance of resource.

On March 28th, 1918, during the great German attack on the Fifth Army the 1st/2nd Lancashire Heavy Battery, R.G.A. (T.F.) (four 60 pounders) was in action at Warfusee. At about 7-30 p.m. the battery received orders to retire owing to the near approach of the enemy's infantry.

During the preparation to limber up German machine guns suddenly opened accurate fire on the position causing many casualties at one gun and making it necessary to withdraw the men from one section. The other section however limbered up and got away.

Lieut. Norman Roberts, R.G.A., however, displaying much gallantry and resource, organised a party and made a screen of ammunition wagons on the exposed flank which caught the machine gun bullets. Under cover of this he succeeded in getting the guns safely away. It was due to his coolness and initiative that this section was successfully extricated.

XXXV. "Carry On."
An incident on the Steenbeek, 1917.

One night during the Battle of Flanders in 1917 two batteries of the 4th Divisional Artillery came under a special bombardment from the German Artillery. The fire was so sudden, fierce, and sustained and covered such a wide area that there was no way of avoiding it. The officers dugouts were hit almost at once and all the officers killed or wounded. Men fell where they stood or died in their shelters. It was raining and dark and almost impossible to see in the gas masks which had to be worn, and more than one man removing his mask to see if his comrade was still living was overcome by gas and so succumbed.

As casualties occurred they were cleared, and more men fell in the act of helping their comrades. By the morning there were hardly a dozen men in the two batteries who could stand up. In the 134th Battery R.F.A. all that were left were Acting Bombardier Fisher and Gunner Houchin. These two men had cleared away the wounded, sorted out the ammunition and squared up the wrecked

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position to the best of their ability—warning orders having come in during the night, before the bombardment started, that a barrage was to be fired; instructions for which would be sent later.

At dawn they were alone in their glory, except for the dead—they were the battery—they had inherited its traditions and meant to be worthy of their Regiment—they would carry out their portion of the barrage as far as two men with one gun could do so.

They took the barrage orders, set their sights and at the appointed hour opened fire. The news had reached the wagon lines, an officer and a few gunners hurried up to the gun line and it was not until the battery came into being once more that the idomitable Fisher gave in and was carried away, gassed.

XXXVI. A fight to a finish.

On the 21st March, 1918, during the German onslaught on the 5th Army, "D" Battery, 177th Brigade R.F.A., was firing on its S.O.S. lines when suddenly German infantry appeared out of the mist on a ridge 100 yards away on the immediate right flank of the battery.

2nd Lieut. Trorey was in command of the battery at the time. The guns could not bring fire to bear from inside their pits so he gave orders for the detachments of the right and centre sections, on which the Germans were fast closing in, to disable the guns and fight their way back with their rifles to a defensive line in rear. He then ran the guns of the left section out of the gun-pits into the open, assisting at one of the howitzers himself, and turned them on to the advancing Germans at point blank range.

Having got these two howitzers into action he himself went to a Lewis gun and opened fire on the enemy, causing many casualties among them. The Bombardier who was helping him to man the Lewis gun was killed by his side but it was not until his available ammunition had run out and the German infantry were within 100 yards and almost surrounding the guns that he gave orders to the remaining gun detachments to withdraw with their breech-blocks and sights.

By this time he himself was seriously wounded and some of the men went to carry him away. But they were under very heavy machine gun and rifle fire and one was killed while bending over him. Seeing the danger to which they were exposed he refused to allow them to carry out their intention and ordered them to get away themselves and join some of our infantry who were manning a trench line in rear. He fell into the hands of the Germans; but his gallantry, resource and coolness were a splendid example to the whole battery. Just after the last of the gunners had left the position, the teams, not knowing the situation, came up in a very gallant attempt to get the guns away. The only route by which horses could get up was through a gap in a line of wire swept by German machine guns. Seven of the 18 drivers and many horses were killed in the attempt. When 2nd Lieut. D. C. McLennan arrived in the vicinity of the gun position with the survivors he found the Germans already in occupation of it and had reluctantly to turn back.

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XXXVII. An incident of Ammunition supply.

During the early days of September 1918 Lieutenant A. F. Blakiston, R.F.A., of "D" Battery, 149th Brigade R.F.A., was taking a dozen ammunition wagons along the Dranoutre-Wulverghem road in daylight.

Once a certain point had been passed this road came under direct balloon observation by the enemy, and any movement on it on a clear day inevitably drew fire; but the call for ammunition was urgent and had to be answered.

A few moments after the wagons had passed this point fire was opened on the road by German high-velocity guns, as anticipated. The little column moved steadily on but, being clearly visible, observation was easy and the fourth shell burst in the midst of the leading team and knocked it out completely. Bdr. F. Smart who was in charge of the wagon immediately in rear of that one—now blocking the road entirely—at once gave the order "Left about wheel—trot," thus getting the remainder of the column out of the way and out of danger for the time being.

Bombardier Smart, after forming up these wagons at the side of the road, immediately returned to help Lieut. Blakiston in extricating the dead and wounded men and horses. Between them they succeeded, applied "first aid" to the wounded, and also managed to get stretcher-bearers and an ambulance. All this time the road was being continuously and heavily shelled. While putting the wounded in the ambulance two of the stretcher-bearers were killed and one wounded. Lieut. Blakiston in order to prevent further casualties sent the full ambulance and all other men away, and he and Bombardier Smart proceeded, by themselves, to carry the dead and wounded stretcher-bearers to a place of safety. When this task was finished Bombardier Smart brought up a pair of unwounded horses, hooked them into the wagon and drove it away.

The hostile shell fire now died away; the column was formed up again just short of the danger point and started down the road at a collected canter. This time the German guns were just too late—the first and succeeding shells fell just *behind* the column during its whole passage over the exposed area, and the ammunition was duly delivered in accordance with instructions.

XXXVIII. Action of an isolated section of the 93rd Battery, R.F.A.

On the morning of the 28th March, 1918, the 56th Division was holding the Southern Spur of the Vimy Ridge, with the 280th Brigade R.F.A. covering the 169th Infantry Brigade which was holding Gavrelle.

A section of the 93rd Battery R.F.A. (280th Brigade) occupied an isolated position near Arleux a few hundred yards behind our front line trenches, from which position it was able to enfilade an intricate system of German trenches in front of a post known as Mill Post near Gavrelle.

An attack by the enemy was hourly expected and on the evening of the 27th March the withdrawal of this section had been seriously

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discussed but the position was considered so valuable that it was decided to risk the possible loss of the guns.

The enemy's preliminary bombardment began at 3-0 a.m. on the 28th and at 7-20 a.m. the Germans attacked in great strength, overwhelming the Infantry advanced posts. The remaining infantry defended the main line of resistance most stubbornly but by 10 a.m. it became evident that there was great danger of the enemy getting round in rear of our troops and a withdrawal to the next defensive line was ordered.

This line was well behind the forward section of the 93rd Battery and consequently the O.C. 280th Brigade sent a message to the Section Commander, Lieut. G. J. Palfrey, M.C., ordering him to fire away all his ammunition, and as our infantry retired to destroy his guns and retire.

This order was duly carried out. Lieut. Palfrey fought his guns under heavy shell and rifle fire until after the last of the infantry had passed them and our covering barrage had crept back to the section. He then placed a round in muzzle and bore, thus shattering the muzzle of each gun—set fire to his dugouts and papers, and retired, carrying away his sights and breech blocks. The detachments bearing their wounded, by taking a circuitous route, and adopting an agressive attitude, were able to avoid capture by the German infantry who were now close on them and reached the main Battery position in safety.

The coolness and determination of Lieut. Palfrey and his gun-detachments were worthy of the greatest praise.

(To be Continued.)

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CONTENTS OF LEADING FOREIGN JOURNALS.

Revue Militaire Générale—August, 1920.

The Military Forces of France (iii). Gen. Thevenet.

Falkenhayn. Breaking through the enemy Defence and exploiting the rupture. Gen. Lavigne-Delville.

Notes on the gun to push forward with infantry. Comdt. P. Raoult.

Foreign News.—Italy. Period of Military service—8 months. Re-organisation of Army. No. of Army Corps reduced from 12 to 10 in spite of increased territory. Infantry Regts. to consist of 2 battalions up to strength, 1 skeleton battalion. Composition of Cavalry, Artillery, Engineers, Air Force.

Gen.. Lavigne-Delville's 34-page article on Falkenhayn is interesting. He gives the instances of successful breaks through, and unsuccessful ones. The failure to use massed formations of cavalry on the part of the German High Command after Charleroi in 1914, in the attack on us in March 1918, and on the Chemin des Dames, Aisne, Vesle (May 27, 1918), to exploit their initial successes, makes Gen. Delville conclude that Germany did not believe in the use of cavalry for this purpose. Not so the French High Command who had big formations of cavalry in reserve when they attempted to break through in 1915, 1916, 1917.

"A chief who does not believe in or prepare for exploitation does not deserve to win."

Examples of successful campaigns.

(1). Serbia. Mackensen in 1915. Franchet d'Esperey 1918.

He draws no conclusions from these campaigns as the circumstances were abnormal and official records are not forthcoming.

(2). Roumania, 1916. Mackensen's use of his cavalry after Targu-Jiu ending in its entry into Bukarest Dec. 5, 1916.

(3). Allenby in Palestine 1918. The battle on the Jaffa—Jerusalem front (19 Sept.) was fought with the idea of passing the cavalry corps through the breach. Result—Cavalry through and behind enemy and capture of VII and VIII Turkish Armies.

(4). Italian victory of Vittono—Veneto. He finishes his article with some interesting conclusions and anticipations.

Revue d'Artillerie—July, 1920.

* * * *

II. Range tables during the war. J. Boissonet commences a series of Articles on the subject of Range tables produced during the war.

III. Liaison between Artillery and Infantry. Impressions of a Field Artillery Officer (i).

IV. German and Austrian High Power guns (continued).

* * * *

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Bulletin Belge de Sciences Militaires—September, 1920.

I. Strategic Railways of the Belgian Army 1914-1918. Part I. Maj. A. E. M. Denis.

II. The war on parasites on the Belgian Front (I). Drs. de Coster, Sillevaerts.

III. The Flooded Area.
Manœuvres carried out during the battle of the Yser in connection with the Inundations. (Photos by Capt. Comdt. E. Dumont). Maj. Umé.

IV. The comfort and safety of the commercial aeroplane. Air Ministry.

V. Heavy Artillery on Railway Mountings as covering artillery. Capt. Comdt. A. E. M. Nicaise.

VI. Notes on Armoured Cars. Capt. Comdt. Vander Donckt.

VII. On the rôle of the Officer seen from the war. Capt. Comdt. Menzel.

VIII. Physical Training in the Army.

Foreign News.—The British Army. Organisation, Education, Physical Training, Staff College, Senior Officers Course, Corps of Military Accountants, Return to pre-war uniform.

Reviews of Books.

The Intelligence Service during the war. By Lt.-Col. Nicolai, German G.H.Q.

Final Despatch of Gen. John J. Pershing (Pershing Final Report—Washington, 1919).

Revue Militaire Suisse—September, 1920.

I. Our tactical principles. Col. Lecomte.

II. Reorganisation of the Infantry. (Concluded). Maj. Schmidt.

III. The Greek campaign in Anatolia. (1 map). Col. Feyler.

Amongst books received is—

"Le plan de Campagne français et le premier mois de la Guerre."

(2 Août.—3 Sept. 1914). Gen. de Lanrezac.
Payot & Cie. Lausanne et Paris. 7fr50.

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"DUNCAN" GOLD MEDAL COMPETITION, SUBJECT FOR 1920-21.

The Subject approved for the "Duncan" Gold Medal Prize Essay 1920-21, is as follows:—

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for horse draught, both on the road and across country."

The Rules for the Essays now read:—

The Annual Gold Medal, when awarded, to be accompanied by an *honorarium* of £20; the Silver Medal by an *honorarium* of £10.

The subject will be a Field (including Horse) Artillery subject one year and a Garrison (including Mountain) Artillery one the next year.

The candidates must be Officers of the Regiment who are members of the R.A. Institution.

Officers of the R.H.A. and R.F.A. will be allowed to compete for the Garrison Artillery subject, and Officers of the R.G.A. for the Field Artillery subject.

Officers are requested to confine their Essays to about 16 printed pages of "The Journal of the Royal Artillery," other things being equal, brevity will count towards success.

The Essays must be forwarded to the Secretary so as to reach him on or before the 1st of April, 1921, they should be marked "Duncan Essay" on the outside of the cover which should be sealed.

Each Essay must be type-written in triplicate. The Essays must be strictly anonymous, but each to have a motto, and be accompanied by a sealed envelope with the motto written outside and the name of the writer inside. Only one of these sealed envelopes is required for each set of Essays not three.

Further, if the writer wishes to recover from the Committee part of the cost of typewriting his Essay he should state this fact in the same sealed envelope, and write outside it, above the motto, "To be opened." All the envelopes thus marked will be opened by the Secretary after the result of the competition has been announced, and he will send the writers the money for their type-writing expenses. The Committee will allow a sum of £1 for type-writing each Essay.

The prize Essays and those commended become absolutely the property of the R.A.I. and cannot be published by the author without the sanction of the Committee. The remaining Essays, if applied for, will be returned, and can be used by their authors.

The Essays will be submitted for decision to three Judges chosen by the Committee.

The Judges are empowered to recommend:—

1.—That two Medals, one Gold and one Silver, be awarded, or

2.—That only one Medal, Gold or Silver, according to the merit of the Essay, be awarded, or,

3.—That no Medal be awarded.

The names of the successful candidates will be announced at the Annual Meeting, and Medalists will be distinguished as such in all Lists, &c., issued from the Institution, and in the event of a University man gaining a Medal, a report of his success will be made to the University of which he may be a member.

The Gold and Silver Medal Essays will be printed and circulated to members by the Institution.

If there are any Essays which do not gain a Medal but are commended by the Judges, it will be at the discretion of the Committee to publish them or not as they think fit.

N.B.—The Committee draw particular attention to the paragraph in the Rules above on the subject of length of Essays; a page of the "Journal" is roughly 550 words.

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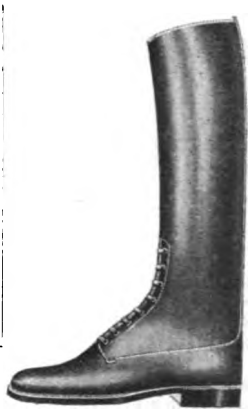

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"DUNCAN" COMMENDED ESSAY, 1919-20.

"The Reorganisation of the Royal Regiment of Artillery with a view to obtaining in war the best value from modern equipments with a minimum of expenditure of human energy."

By Major R. G. Cherry, M.C., R.F.A.

"EXPERIENTIA DOCET.

INTRODUCTION.

THE history of war throughout the ages shows a slow but progressive development of weapons and martial equipment, all tending towards the conservation of human energy by the invention of mechanical devices.

Moreover, as man's instinctive object has always been to strike without being struck, he has always striven to evolve methods whereby he can inflict the greatest loss on the enemy at the least cost of energy or injury to himself.

Success in war, when there has not been overwhelming disparity of numbers, has gone to the master-brain, whether that brain was employed in the invention and use of superior weapons, or in superior leadership and direction.

The great leader, the genius in war, cannot be produced at will, but there is nothing to hinder the concentration of the national brain upon the improvement of weapons of offence and defence. The Nation that will win the next great war will be the one that has successfully deduced the lessons to be learnt from the latter phases of the late war, and has been able to adapt its fighting resources to the changed conditions of modern and future warfare.

Never, throughout the history of war, have such radical changes been wrought in such a short period of time, and never was the need so great to look ahead, to scrap all that is now obsolescent, and to keep in touch with every invention that may alter still further our pre-conceived ideas on the conduct of war.

New weapons.

The outstanding features of the latter phase of the last war, which are bound to have an immense influence on all future wars, were the paramount influence of mobility on the course of events, the development of aeroplanes, of tanks and tractors, and, in a lesser degree, the use of poison gasses and smoke.

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It is these new features that must be considered when the artillery arm is re-organised.

Influence of mobility.

Perhaps the greatest lesson to be learnt is the great advantage conferred to the combatant that possesses greatest relative mobility. This was seen from the beginning in the power given to the Germanic forces by their possession of interior lines to transfer large forces rapidly from one sector of their front to the other. Thus France, Russia, and Italy in turn could be attacked and almost overwhelmed, while the rest of the front was comparatively quiescent.

The long stalemate on the Western front was due to the immobility of the opposing forces: that is to say, to the failure of either combatant to break through the enemy's defensive system and maintain an offensive war of movement against him. This immobility was due to the limited nature of the lines of communication, and to the difficulty of maintaining their efficiency, as soon as the first object, the capture of the front system of defence, was achieved.

The long range powers of heavy artillery and of air-craft enabled these arms to deluge the well-known channels of communication with gas and high explosive, and thus hamper fatally the stream of supplies, ammunition and reinforcements that was always necessary, to enable the attacking force to keep moving forward. Had it been found possible by either combatant to multiply indefinitely these narrow channels of communication, and to maintain thereon a continuous stream of supply, it is evident that the problem of maintaining an offensive would have been solved.

As it is this power of maintaining an offensive indefinitely that confers complete and speedy victory, it is clear that every innovation or change in strategy, tactics, or armaments, that tends to increase this power, is a step towards the realisation of our object.

Modern war, by its demands for the mobilisation of the national resources, paralyses the economic life of the nation. The strain induced on combatants, on and behind the fighting front, gets more and more excessive, owing to the intensive way in which warfare is conducted.

A prolonged war, with its doubts, fears and set-backs, has the effect of dulling the moral and material effects of victory, and is apt to produce discontent and even disruption among the eventual victors. When a quick decisive victory is obtained, national dislocation, strain, expenditure, loss of life and energy, are not so great, and the nation will reap the full benefits of its success.

The secret, therefore, of complete and full success lies in mobility, and in the power to maintain that mobility, in spite of all hostile efforts to bring it to a standstill.

Aeroplanes in observation.

The last phases of the war saw the influence of aeroplanes on the other arms exerted mainly (a) in observation (b) in destruction.

The "artillery" squadrons of the Royal Air Force, co-operating with the gunners, enabled the latter to bring observed fire on to

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targets that would otherwise have been invisible. By flash observation and photography they enabled hostile works to be accurately located and engaged, and by visual observation they were able to warn the artillery of the approach or withdrawal of hostile troops. These squadrons, with the army reconnaissance squadrons, kept local Commanders supplied with photographs of the hostile defence system, reconnoitred the back areas and lines of communication, and supplied the Infantry with contact patrols to assist them in operations.

Observation balloons supplemented the work of the "artillery" machines and kept a practically continuous watch on the front.

These multifarious duties, all of which were carried out under fire from the ground, and exposed to attack from the air, demanded a high standard of training and endurance on the part of the observers, and imposed a strain on the resources of the Air Force. Future developments in artillery observation should lead to the work of observing being done by the Battery Commander or by an officer deputed by him. Progress is being made with the wireless telephone, and when this very delicate instrument is reliable, it is clear that it must replace the more cumbersome telegraph. The advantage of having fire observed, directed, and controlled by a Battery Commander in the air is obvious: in the late war it was impracticable, as Battery Officers could not be spared from their units to undergo the necessary aerial training.

It should be made possible in the future for a Brigade Commander to arrange for any of his officers to take the air and control the fire of any or all of the batteries in the Brigade. This could not be done unless these officers had passed an Observer's Course with the R.A.F., and had thus become qualified machine gunners and experts in the use of the wireless telegraph and telephone. From the R.A.F. point of view this method would have the great advantage of economising their own observers, who would then be kept for reconnaissance and patrols, though able to do artillery work if required.

It is suggested also that a proportion of officers of heavy artillery should pass a course of balloon observation, with a view to relieving balloon observers of the actual shooting of the heavy batteries. If artillery units were provided with light tractor cars, communication with their affiliated R.A.F. squadrons would be easily and constantly maintained.

Aeroplanes in destructive action.

As an instrument of destruction the aeroplane is likely to be used in the future on a very large scale. Numerous bombing-raids will take place against objectives a long way off; for the broader become the channels of communication, immediately behind the fighting forces, the further back will the bombing aeroplanes have to go, in order to achieve important results. It will, therefore, be necessary to guard advanced Bases, Railheads, and Ports of disembarkation, and possibly Home Ports and the London area, with anti-aircraft guns. The problem of stopping raids by day and night will

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become increasingly more difficult as raiders fly at greater heights and speed.

The late war has shown that the direct hit, involving the bringing down of the aeroplane out of control, has a moral effect out of all proportion to the result. A raiding squadron regards with comparative equanimity the loss of three of its complement, when the remainder see these machines gliding down to a safe landing. It is a very different matter when these three machines are seen to be destroyed in mid-air by direct hits. Anti-aircraft artillery should therefore aim at methods likely to secure direct hits, which object is likely to be achieved by accuracy, much increased rapidity of fire, and higher muzzle velocity to give a shorter time of flight of the shell. The great difficulty in attaining the efficiency in training, that only comes by practice, lies in the difficulty of obtaining target practice in peace time.

The difficulty will have to be overcome by establishing our Anti-Aircraft School in close conjunction with a R.A.F. Experimental Establishment on, or near, the coast, where firing practice may take place against actual targets towed or set adrift by aeroplanes, and where touch can be kept with the latest developments and inventions in aircraft.

So much for the action of the artillery in the defence of localities. The actual defence against aircraft by battery personnel of their guns in action will have to be considered in the light of recent inventions. During the late war, there were not many instances of attacks on battery positions by low flying aircraft, though a considerable amount of low flying reconnaissances took place. Now, however, in addition to an aeroplane gun firing a small H.E. shell that is claimed to have been produced by an American designer, the aerial torpedo has been successfully tested and is capable of being used on a large scale. An aeroplane, launching two torpedoes of about a hundredweight in the direction of its dive, should make a good percentage of hits on a target the size of a gun and wagon, and so do a great deal of moral and material damage to the opposing artillery.

The best protection that the gunner has against these aeroplanes, that will dive at a very high speed to within a few hundred feet of the battery, lies in machine gun fire. A barage of armour-piercing machine gun bullets should ward off these attacks, but fire, to be effective, must be accurate and therefore a high standard of training in machine gun fire tactics and fire discipline will be necessary.

Tanks.

The great success achieved by the Tanks in the later phases of the war undoubtedly brings home the lessons that the Tank of the future will effect sweeping changes in the conduct of war, and that the tractor must inevitably replace the horse as the motive power for the Army as a whole and for practically all natures of Artillery. Trace, first of all, the development of the Tank as a fighting machine and as an initiator of the war of movement. The first phase began with the début of the Tanks on the Somme in 1916, where they were

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used in small numbers and as a subsidiary arm. For these reasons and also because they had to operate over ground that had been heavily shelled for two years and was sodden with rain, decisive results were not achieved.

The potentialities of this weapon were, however, recognised and several notable exploits carried out. The battle of Cambrai, 1917, heralded the second phase, and the opening success in that battle was undoubtedly due to Tanks which were used for the first time on a large scale in the place of the Artillery bombardment, and as an arm of primary importance.

During the German offensive in March, 1918, Whippet Tanks were used by us for the first time, and much useful rearguard work was done by them and by the larger tanks.

From the commencement of the Allied offensive, Tanks were used on the whole Allied front in every important operation, and on a large scale. During the operations from August 8th until the Armistice, the Tank Corps showed that a method of overcoming the resistance of the trench system had been found. These battles, which were won by a force numerically smaller than the defence, were indeed a trumph of machine-power over man-power. Positions, hitherto considered impregnable, were over-run, the hostile Infantry was to a large extent deprived of the support of its Artillery which devoted much of their energy in trying to stop our Tanks, and the German morale sank immeasurably with each mile they retreated.

During the course of these operations, which lasted about a hundred days, nearly 2,000 Tanks were employed by us at a cost in casualties to personnel of about 3,000 men. The Germans themselves admitted freely that it was this use of Tanks that was mainly responsible for their defeat. Captured orders constantly referred to methods of anti-tank defence, and their Press towards the end of the war criticised savagely the General Staff for not having foreseen the Tank development and taken effective counter-measures.

The closing events, therefore, of the war showed that the Tank was an effective counter to trench warfare, and provided a means of locomotion across country independently of roads. If this power of cross-country movement is extended back over the lines of communication, the power of maintaining offensive movement, broadening the channels of communication, and enhancing rapidity of supply, will be conferred by the armoured tractor.

In considering future development of the Tank and the influence it will have on warfare in the future, it must not be forgotten that the anti-tank defences set up by the German Army were improvised and ill-designed. This was chiefly due to their failure to anticipate their use on a large scale. Before the end of the war, anti-tank machine guns had been designed and were on order, and a serious if belated effort had been made to nullify Tank activities.

Future anti-tank defence will be either active or passive. Active defence will take the form of aerial attacks with torpedoes or large calibre machine guns firing armour-piercing bullets. On the ground, the defence will be mainly with large calibre machine guns or quick firing artillery. The most effective way to destroy a tank or an

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aeroplane is to ignite the petrol supply carried by both. If the development of the penetration power of machine gun bullets can outstrip the resistance of tank armour, the latter would appear to be doomed. The thickness of armour-plate is limited by weight which is itself limited by the horse-power efficiency of the engine: this should not prove unequal to the task.

A direct hit from a high explosive shell fired from a high velocity gun of about 4 inch calibre would knock out, by the shock of impact alone, all but a tank of battle-cruiser size and construction, and the tank of the next few years will have to rely chiefly on speed and manœuvre to avoid destruction by artillery fire.

Passive anti-tank defence will take the form of grenades, land-mines and obstacles, natural and artificial. It would seem that we are a long way from the battle-cruiser tank, and the introduction of naval strategy and tactics into land warfare. Tank developments in the near future are likely to be on the lines of improvements in speed, cross-country manœuvring power, armour and armament.

The fighting tank will be used as an auxiliary arm to the Infantry, probably under Infantry control: the supply tank will, to a great extent, take the place of the lorry, and will be used to move up Infantry with their supplies: while, as shown in this paper, other types of tractor will be used as motive power for the artillery.

Tractors.

However the employment of fighting tanks may be affected by anti-tank inventions, it is not easy to see what developments can restrict the use of cross-country tractors in place of horse transport. The influence of cross-country traction on mobility has already been discussed, and it now remains to point out the economy in time, material, bulk, weight, food, human energy and man-power that could be effected by the replacement of the horse by mechanical horse-power.

The first problem that arises in connection with horse transport is that of food, and food supply. Now, a Brigade of Artillery, exclusive of its ammunition column, employs on a War Establishment about 560 horses or mules used for draught purposes. These animals require about 4 tons of food a day, and require this food every day whether they are in movement or at rest. Under the most favourable circumstances these horses cannot be expected to move more than 30 miles a day, and this rate of movement cannot be kept up for long. It has been calculated that 4 tons of motor fuel would take an equivalent horse-power value of tractors a distance of 40 to 50 miles a day, and this fuel would only be used when the tractors are actually in movement.

Again it is necessary to compare the bulk, i.e., space occupied by this tonnage of horse-forage, composed of corn and hay, against that occupied by petrol, oil and grease. This is particularly important when it is remembered that our wars have always taken place overseas, and that therefore shipping has been necessary for the transport of supplies. Not only would tractors themselves occupy a very small ship space compared to the equivalent power in horse-

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flesh, but their fuel is very much more compact, easier to handle and less liable to deteriorate.

The next problem, in dealing with horse-traction in war, is that of the safeguarding of horses on or behind the battle front.

The wastage during the late war in horses was enormous, especially during the later stages.

Long range shelling and aeroplane bombing by night and day frequently decimated the horse-lines, even during the comparative calm of trench warfare, whereas during the war of movement, advance and retirement both involved a serious loss in horse-flesh.

Although the losses among animals from gas were not so great, it is to be expected that the gas of the future will be as lethal to horses as to men, and it will be much more difficult to protect horses than men in case of sudden gas attacks.

On the other hand, a tractor is not only not affected by gas, but can be made to afford complete protection. Such a machine could be fitted with a gas tell-tale which would enable the tractor to be closed hermetically. Personnel taking cover therein would be supplied from cylinders of oxygen or compressed air; a further development of this method of gas protection would be to lead tubes from the gas-tight tractor to gas-masks worn by detachments working the guns.

Another problem in connection with horse-traction is the excess of personnel used in driving and looking after the horses. Each pair of draught horses must have a driver, and there is also a large staff of farriers, shoeing-smiths, etc. Almost all this man-power might be eliminated if mechanical tractors were employed. A battery would then consist of only those men who were required to serve the guns, with the addition of one driver per tractor to look after its engine, fuel, and armament, and with a small staff of artificers to supervise running repairs. The No. 1 of the gun would be trained in tractor driving and tractor mechanics instead of horsemastership, and the remainder of the detachment would be specialists in gunnery with a working knowledge of tractor mechanism. In round numbers, the transport horses of a Field Artillery Brigade now require 320 men to look after them: the equivalent value of tractors would require about 70. The problem of ammunition supply will be made very much more simple by the adoption of tractors. A supply tank, as exists at the present time, carries ten tons of ammunition. A tractor of similar engine horse-power, drawing a gun weighing 25 cwt., carrying detachment, fuel, etc., weighing not more than 30 cwt., could carry over 7½ tons of ammunition. A tractor of half this horse-power would carry 2½ tons of ammunition, or the equivalent of 250 rounds of 18-pdr. or 150 rounds of 4.5 inch howitzer for the gun. At present each gun has 86 rounds carried in gun limber and ammunition wagon!

An ammunition column of tractors consisting of one ammunition tractor per gun, would carry at least 250 rounds per gun of 18-pdr. ammunition against 62 carried at present.

It will be seen from the above round numbers what an enormous amount of ammunition transport, moving to and fro on the lines of communication, would thereby be saved.

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From the point of view of peace economy, the tractor has the same advantages, besides being a useful civil machine. There is no reason why a standard form of tractor should not be used for agricultural and other purposes, of a type that could be used for artillery and other draught in war. The men who learn in the Army the mechanism and driving of tractors are thereby learning a most useful trade, whereas men who nowadays learn how to groom, ride and drive Army horses are learning a trade that will in civil life be useful only to a small proportion.

Gas.

In spite of the Peace of Versailles, it is practically certain that gas will be used in future wars, and on a very large scale. During the later phases of the last war it was used (a) to cause casualties by surprise attacks (b) to cause fatigue and discomfort and so to lower efficiency by compelling the use of gas-masks for a long time, (c) to deny the use of ground by continuous shelling with a heavy persistent gas.

Although the box respirator, when properly used, gave the wearer immunity against all gases than employed, it cannot be assumed that this counter-measure will be effective in the future.

It is probable that the opening stages of the next great war will see the introduction of gasses quite different from those known to us now. Chemical research in this direction will have a two-fold object—(1) to increase penetration, (2) to increase persistency. The selected gas will be kept secret until war breaks out and then used in large concentrations, as gas clouds, as bombs fired by projectors, as shell of light and medium calibre, and as aeroplane bombs. The effect of subjecting back areas and lines of communication to heavy shelling and bombing by highly lethal and persistent gas, would be to cause much disorganisation among personnel and animal transport. Personnel, however, that could get away from the contaminated area, or was adequately protected by gas-proof lorries or tractors, would not be affected. The protection afforded to artillery personnel by gas-proof tractors has already been mentioned. Such machines would be able to cross areas deluged with gas, and would in fact nullify to a great extent any advantages that an enemy, using an unknown and unexamined gas might otherwise obtain.

Smoke.

The later phases of the last war saw great advances made in the use of smoke and smoke screens. And it is probable that smoke tactics will be so developed in the near future that smoke will form an important feature of all operations.

More particularly will it be used by the mobile artillery in masking tank movements, and in preventing the hostile artillery from bringing direct fire to bear on our tanks by putting down a smoke barrage in front of their battery positions. A smoke screen will also put up on occasions such as when the tanks have made good an important tactical position, and the Infantry, following up, are making the ground good.

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Tanks will also produce their own protective smoke screen when forced to withdraw, and smoke signals to indicate their positions to each other and to the Infantry.

This protective screen will be used by the tractor-drawn gun of the future in order to mask its own movement, and especially to cover a withdrawal.

The study of smoke tactics will, therefore, in the future, have to be taught in the same way that fire tactics are taught today.

Future Wars.

The probable features of an European campaign conducted within the next two decades are likely to be roughly as follows:— The campaign would open with strategical reconnaissances by aeroplanes with long distance bombing raids designed to hinder concentration of troops and supplies.

The strategical advance guard would consist of fast scouting (Whippet) tanks supported by light mobile artillery and machine gun units.

The striking force would consist of Infantry carried in lorries and supply tanks supported by heavily armed and armoured fighting tanks, with artillery, engineers and other auxiliary services, the whole mechanically drawn and moving by road and field.

The trench system of defence would not re-appear except in certain localities wherein tanks and tractors could not operate. The Army forced to act on the defensive would pivot his defences on broad rivers, forests or swamp, defending ordinary terrain by gas inundations, land-mines, or by special concentrations of aircraft and artillery.

As the arm of pursuit would be the fast tank, so the defensive arm in the retreat would be the mobile artillery, which would have to find its own machine gun protection.

The conduct of small wars and punitive expeditions will be enormously simplified by the use of tanks and tractors, which will to a great extent do away with the bug-bear of long lines of communications in a hostile country. A small force of aircraft, tanks and tractors will be able to do the work of divisions with greater efficiency and with a minimum cost.

Generally speaking, the main effect of modern conditions will be to speed up operations, to increase the mobility of supply services, to render a stalemate most improbable, and to give success to that nation that attains and maintains a higher standard of mobility.

Functions of Artillery.

How, then, should the Regiment be re-organised to meet the demands made upon it by modern inventions, and by the new mechanical conception of movement? Artillery in the field will be required to carry out the following functions:—

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A. MOBILE ARTILLERY.

(1). Close support of tanks.
(2). Anti-tank defence.
(3). Infantry support.
(4). Counter battery.

B. PACK ARTILLERY.

(1). Operations in terrain inaccessible to tractors.

C. ANTI-AIRCRAFT ARTILLERY.

(1). Battle front defence.
(2). Base and Railhead Defence.
(3). Home Defence.

D. HEAVY ARTILLERY AND ARTILLERY OF POSITION.

(1). Counter battery.
(2). Reduction of Defence Centres.
(3). Fortress Defence.
(4). Coast Defence.

These functions have been grouped into Mobile, Pack, Anti-Aircraft and Heavy, which, it is suggested, should form the distinctive branches of the Regiment.

Mobile Artillery.

(A). Mobile Artillery would comprise all modern guns that can now be taken across country by horses or tractors, that is to say, the light and medium guns of the field army.

The attack and defence of tanks is a problem affecting the 13-pdr. and 18-pdr. guns and their successors. The probable evolution of this gun, which will be required to move with fast scouting tanks, will tend towards a weapon of smaller calibre and of increased rate of fire, mounted and carried inside a tractor. This gun will be the successor to the R.H.A. whose dash and smartness it should inherit.

The support of Infantry and counter battery work at close and medium ranges will be carried out by the improved 18-pdr., the 4.5 inch and the 6 inch howitzers and the 60-pdr. gun.

Owing to the increased mobility given by tanks and tractors, the primary objective in future battles will be the back area behind the line of the enemy's Divisional Headquarters, while the zone of the enemy's guns will form the secondary objective.

This means that the lighter, or Divisional Artillery, should have an accurate barrage range of 12,000 yards, and the heavier or Corps Artillery, a range of 20,000 yards. The importance of the smoke barrage, which is more effectively put down by the light (4.5 inch) howitzer raises the question of the advisability of increasing the proportion of howitzers to guns in a light mobile brigade. It is again emphasised that all this light and medium artillery should be tractor drawn, so as to keep pace with the infantry and tanks.

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Pack Artillery.

(B). As it is not possible to visualise a tractor that will operate effectively over swampy ground, mountains or forests, it is necessary to utilise pack artillery to assist in overcoming resistance in such natures of country. A light quick-firing howitzer would seem to be the best weapon for the purpose, and mules the best means of transport. Progress over this sort of ground is bound to be slow for all arms in the face of determined resistance, and in the case of forest or marsh, unless the area was very extensive, it would usually be out-flanked, and the fighting would then be of the nature of mopping up on a large scale.

Anti-Aircraft Artillery.

(C). Anti-Aircraft Artillery has been put in a category apart, because the problems, arising in connection with this branch of gunnery, differ very considerably from any other.

To begin with, anti-aircraft gunnery deals with three dimensions, the targets engaged are of an entirely different nature, move at a very high rate of speed and in a manner quite unlike any ground targets. Gun drill and fire tactics are therefore quite different, and the training of officers and men cannot be carried out in conjunction with other units of the Regiment or of other arms except the Royal Air Force. It has been stated already that anti-aircraft gunnery to be effective must be most accurate, and this accuracy can only be obtained if officers are absolute masters of their profession, and if range-takers, dialmen, and detachments are experts in their duties. This cannot be obtained by interchanging personnel with other branches of the Regiment.

The weapon that will be used against hostile aircraft in the front zone should be able to reach machines flying at 12,000 feet, and should be independent of roads, so that it may keep up with the division in the advance.

The weapon required for defence of localities against bombing raids should be able to kill at 25,000 feet, and should also have a rapid rate of fire. These guns would be used in conjunction with searchlights and sound-ranging parties. The increasing range of modern aircraft makes it possible that raids may again take place on the metropolis. A successful raid at the outbreak of war would have a great moral effect and would divert from the battle front our own fighting machines and guns. Such defence should be entrusted to units of the Territorial Force, organised in peace time and armed with the guns they will use in war.

It should be noted that anti-aircraft artillery will not provide machine gun defence against aircraft. Tractor-drawn artillery can provide its own defence by means of a light machine gun mounted on the tractor.

Heavy Artillery.

Owing to the increased mobility of armies the heavy gun is not likely to play such a prominent part in future wars. The weight of gun, carriage and ammunition prohibits rapid movement, and it is

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probable that in the encounter battle it will only be used for counter-battery work, area strafing, etc., in the early phases.

When the enemy's front zone has been pierced, movement will be so quick that only the mobile guns will be able to support the Infantry and tanks in the subsequent phases.

The heavy guns will then be used in the attack of strongly defended points d'appui, the modern counterpart of the old frontier fortresses.

As it will not always be the case that our armies are everywhere on the offensive, recourse will probably be had to fortified points d'appui on sectors of the front on our side. These will act as rallying and refilling points for tanks and tractors and will be prepared for anti-tank defence. To these places will be allotted units of the heavy artillery, whose role will be to keep at bay hostile artillery and gain time for a counter offensive.

It will not be necessary for this heavy artillery to be tractor-drawn, and future improvements will take the form of increased range and accuracy rather than increased mobility. The first essential for artillery of this nature is accuracy of fire; as increased ranges are obtained, aerial observation will become more important, and the need of trained aerial observers, who are also gunners, will be vital. It will always be found necessary to retain a certain amount of positional artillery to protect home ports and bases, coaling stations, etc. It is thought that developments will again in this case tend towards greater ranges and increased accuracy.

These stations at home and abroad will form the training ground for the heavy artillery above mentioned, as mechanism, drill and gunnery problems are very similar. As troops of other arms are stationed in most coast stations, training for the field can be carried on and liaison maintained.

Artillery Establishment.

In framing an Establishment for the Regiment, it will be necessary to look ahead to the new conditions, and at the same time to base it on our probable military requirements as indicated by the recent Army Estimates.

At present we maintain a striking force of one Cavalry Division and six Infantry Divisions, besides a force serving abroad guarding our interests in the East. It has been pointed out that this latter force will in the future be considerably reduced when the policing powers of aeroplanes and tractors have been developed.

It is probable that the Cavalry Division, as such, will gradually be replaced by a force of improved fast light tanks, supported by armoured car, motor machine guns, and light field guns at first drawn by tractors and later carried in tanks.

The force evolved from a Cavalry Division of four Brigades, would require 12 fast mobile batteries tractor-drawn and formed from R.H.A. batteries.

The six Divisions will be formed as one Army of three Corps and will be composed of heavier battle tanks, Infantry liberally

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supplied with tractor transport, tractor-drawn artillery, Engineers, etc.

The present allotment of 3 light mobile Brigades of 4 batteries to a Division has stood the test of war up to date, and may probably continue, and in addition each Corps will have its complement of medium mobile artillery. This, it is suggested, would consist of the equivalent of one Brigade of three batteries of 60-pounders, and two Brigades of three batteries of improved 6 inch or 8 inch howitzers.

Heavy artillery would belong to Army Troops, and would consist of about one Brigade of heavy howitzers, one Brigade long-range high velocity guns, a certain amount of pack artillery, depending on the nature of the country in which operations were taking place, and a few heavy railway guns. Anti-aircraft artillery should be in the proportion of at least 6 guns to a Division, with a further allotment of 6 guns to each Corps, and 18 guns to army troops.

The Territorial Force would be similarly organized, armed and equipped, as would all new Divisions that might be mobilised if the campaign lasted sufficiently long to enable this to be done.

The provision of Artillery for coast defence is likely to be affected by developments in Naval warfare. The possibility must not be overlooked of the aeroplane driving the large battleship under the sea. Ports, dockyard and other important points will then have to be guarded against possible raids by large submersibles. It is not anticipated that there will be much change in coast defence stations in the near future.

We thus arrive at the following figures:—

HOME ARMY.

Mobile:—12 fast light mobile batteries in 4 Brigades.
72 light mobile batteries in 18 Brigades.
9 medium mobile gun batteries in 3 Brigades.
18 medium mobile howitzer batteries in 6 Brigades.

Pack:—3 batteries of Pack Artillery in one Brigade.

Anti-Aircraft:—12 anti-aircraft batteries in 4 Brigades.

Heavy:—3 heavy gun batteries in one Brigade.
3 heavy howitzer batteries in one Brigade.

Coast:—30 batteries in 10 Brigades.

OVERSEAS ARMY.

Mobile:—24 fast light mobile batteries in 8 Brigades.
36 light mobile batteries in 9 Brigades.
3 medium mobile gun batteries in 1 Brigade.
6 medium mobile howitzer batteries in 2 Brigades.

Pack:—15 batteries of Pack Artillery in 5 Brigades.

Anti-Aircraft:—6 anti-aircraft batteries in 2 brigades.

Heavy:—Nil.

Coast:—18 batteries in 6 Brigades.

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The total of Overseas Artillery is suggested as being likely to be required for the next decade.

Light mobile and pack artillery are much more likely to be required than the heavier natures, as conditions generally in the East do not favour the use of heavy ordnance.

A total of first line artillery is thus arrived at:—

269 Batteries in 80 Brigades.

Peace Establishment.

The problem now resolves itself into providing a Peace organisation which will permit of the immediate production of the Striking Force. In addition, depots and training stations will be required to keep the overseas units up to strength, and Schools of Instruction for each nature of Artillery, together with Schools where the developments of each branch of Artillery work can be studied and taught. The solution is discussed under three headings: (a) the necessary Peace Establishments, (b) how to provide personnel, (c) how to co-ordinate and keep up-to-date the training of that personnel.

(A). The complete evolution of light and medium mobile artillery from horse to mechanical horse-power must be carried out gradually and progressively, so that at any given time every unit is fit to take its place in the field.

A rough proposed War Establishment for a Brigade of light mobile artillery is given, as an indication of the saving in personnel by the change:—

Personnel.	Officers.	Gunners.	Sigs.	Pet. Drs.	Artfs.	Mtr.Cys.	Misc.
Brigade H.Q.	3	-	10	4	-	5	6
4 Batteries each ...	5	60	6	9	6	3	8
Bde. Ammn. Column	4	-	5	40	16	9	6

Vehicles.	Light Tractor Cars.	Motor Cycles & Side Cars.	Tractors.	Workshop Tractors.
Brigade H.Q.	3	5	-	-
4 Batteries each ...	3	3	6	-
Bde. Ammn. Column	4	4	24	4

A few explanatory notes are necessary.

All vehicles, including motor cycles, will eventually be designed for cross-country work.

All tractors will be of the same design, that is to say, lightly armoured, covered, capable of carrying 3 men outside and 6 inside, and 5,000 lbs. weight of ammunition. This is the equivalent of 250 rounds 18-pdr. shell, and 150 rounds 4.5 inch howitzer shell.

The tractor will carry, besides, one light machine gun forward, mounted with a 180° horizontal traverse for infantry defence, and one light machine gun upward on an universal joint for aircraft defence. These tractors will, as mentioned, be made gas-tight and

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fitted with cylinders of compressed air. They will carry their own fuel for 100 miles. All light tractor cars will have the engine armoured, the front protected by armour, and will carry two light machine guns and 6 men. Motor cycles will each have a trailer and one light machine gun.

In the columns of personnel, only those trades necessary for the working and moving of the guns, and for communication purposes, have been shown in detail. A wastage of 25% on total strength of drivers and motor cyclists has been allowed for in the Establishment for the ammunition column.

It will be observed that a saving in man-power of over 400 is effected, and over 7,000lbs. more weight of ammunition per gun than with the present horse-drawn equipment.

A workable Peace Establishment for the same unit would be somewhat as follows:—

Personnel.	Officers.	Gunners.	Sigs.	Pet. Drs.	Anti A/C	Mtr. C/C	Misc.
Brigade H.Q.	3	-	4	2	-	2	6
4 Batteries each ...	5	48	6	6	4	2	6
Bde. Ammn. Column	1	-	-	14	8	2	3

Vehicles.	Light Tractor Cars.	Motor Cycles & Side Cars.	Tractors.	Workshop Tractors.
Brigade H.Q.	1	2	-	-
5 Batteries each ...	2	2	4	-
Bde. Ammn. Column	1	1	8	2

It should be noted that while a slightly reduced personnel for the three sections of a battery is maintained, transport for two sections only is allowed. It is assumed that a third of the Officers and N.C.Os. of the battery will be on courses at the different Schools of Instruction, except during the period of battery and brigade training.

Enough transport is provided in the ammunition column to move either all the guns in the brigade, or to allow one battery at a time to be drilled as a unit with 6 additional tractors for ammunition replenishment.

A war and peace establishment for medium mobile, or anti-aircraft artillery would follow the same lines. Units of light and medium artillery would occupy existing barracks, the stables of which would be adapted to take tractors and to form workshops. There appears to be no need to alter the present establishment of a Brigade of Pack Artillery, which would presumably be stationed in Scotland or Wales, and find drafts for Pack Units overseas.

Heavy Artillery would be found from Coast Artillery on mobilisation; certain personnel would be earmarked as the cadre of heavy batteries, and officers would take part in Staff rides, etc., with neighbouring troops. For light and medium mobile artillery a certain

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number of depot stations or training brigades would be necessary in addition to the stations of units of the striking force. These training brigades would undertake the yearly training of Reservists and the initial training and equipping of drafts for Overseas. On the basis that one training brigade could thus supply 3 brigades of fast light mobile, or 2 brigades of light or medium mobile, eight training brigade stations would be required.

Anti-aircraft batteries should be stationed at active air stations as far as possible in close proximity to troops of the Division to which they are affiliated. Close liaison would thus be kept with the actual pilots of the Air Force, without interfering with training with troops of the Army.

Supply of Personnel.

(B). The Establishment suggested above, together with the personnel of Schools of Instruction, would employ in round numbers 2,000 officers and 20,000 other ranks in peace. It is considered that officers and men should remain for the greater part of their service with one branch, mobile, pack, anti-aircraft or heavy. At the same time it is not desirable that the branches should be kept entirely separate, as is the case at present with the R.F.A. and R.G.A. The system now advocated of a main body and branches, when modified, would meet the scheme of reorganisation suggested above.

As regards the supply of men, recruits would be sent to a common depot and there classified according to technical knowledge and physical ability. They would then either be posted to units to be trained as gunners or signallers, or would be drafted to the tractor school to be trained as petrol drivers, cyclists or artificer learners, being posted from there to units as required. As there is not a great difference between the proposed War and Peace Establishments, a service of 6 years with the Colours and 6 years with the Reserve would meet requirements and ensure efficiency among the rank and file.

Schools of Instruction.

(C). The training of all personnel on the Peace Establishment must be intensive. All Officers and N.C.Os. serving on Home Establishment should go through the schools of instruction necessary for their branches, and no Officer or N.C.O. should be posted abroad until he has been through these schools. In this way uniformity of drill and training is ensured, and every Officer and N.C.O. should become a specialist in his branch of the Regiment.

The schools of instruction considered necessary are as follows:—

(1). Central School of Gunnery:—For theoretical gunnery, drill on new equipments, range finding and sound ranging, experimental tests, calibration. (Shoeburyness).

(2). School of Mobile Artillery:—For training in shooting, fire tactics and smoke tactics, for Officers and N.C.Os. of that branch. (Larkhill).

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(3). School of Heavy Artillery:—For training in shooting for Officers and N.C.Os. of that branch. (Golden Hill).

(4). School of Anti-Aircraft Artillery.—In conjunction with Experimental School of Flying, for training in shooting for Officers and N.C.Os. of that branch. (Orfordness).

(5). School of Pack Artillery:—For training in shooting for Officers and N.C.Os. of that branch. (Trawsfynedd).

(6). Tractor School:—In conjunction with the Tank Corps Experimental Station, for experiments in tractor and tractor car design, and for instruction of drivers and artificers.

Officers and N.C.Os. would go through a course of instruction on Tractors.

(7). Schools of Aerial Observation:—(a) Course of aerial machine gunnery, photography and map-reading at a R.A.F. School of Observers, (b) course of Artillery observation in conjunction with a School of Mobile and Heavy Artillery.

(8). Machine Gun, Signalling, and Anti-Gas Courses at Army Schools of Instruction in conjunction with men from other branches of the service.

It is important that a large proportion of gunners in mobile batteries should be trained machine gunners, so that these units may dispense with Infantry escort or protection.

It was said by critics of the Army under the old system that it was the most over-examined and under-instructed Army in the world.

However that may be, the last war has shown that the modern soldier must be a handy man, an expert at every duty he may have to perform. It is by intensive training that it will be possible to economise personnel; and it is by the mechanical skill acquired after intensive training that human energy will be conserved.

Summary.

An endeavour has been now made to point out changes in methods that have become advisable owing to the developments and inventions in war weapons and tactics.

The most important of the points raised are:—

(1). Closer liaison with the Flying Service, with a view to the gunner officer himself controlling the fire of his guns from the air.

(2). Increased mobility and great economy of muscular energy given by the introduction of tractors as suppliers of motive power.

(3). The consequent reorganisation of the Regiment, according to the mobility of its branches.

(4). The establishment of anti-aircraft artillery as a separate branch, with strong liaison with the R.A.F.

(5). A more intensive and methodical adjunct to training in the unit, in the form of periodical courses.

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In advocating changes, it is borne in mind that changes should only be made from existing conditions when an absolute increase of efficiency is thereby obtained, also that such changes must be gradual and progressive.

Speculations relating to the distant future have been avoided, and only those new weapons, conveyances and ideas discussed that are actually in the process of evolution now. The wireless telephone, the aerial torpedo and the fast tractor are all in existence, and are all capable of vast improvement and of being applied on a large scale to modern warfare. What one nation can invent another nation can copy, and it would be the height of folly not to prepare for war in the expectation that the enemy would be as well armed as oneself.

Conclusion.

In conclusion, it is realised that the keystone of the above suggested reorganisation, that is to say, the creation of a Mechanical Artillery. strikes hard at one of the greatest traditions of the Regiment. The disappearance of the horse in war leads inevitably to its elimination in peace time, and with it goes much that makes the life of the Regimental Officer so pleasant.

War is, however, no respector of prejudices or traditions, and, as so many thousands in the Regiment gave everything for the Nation in the last war, it should not be too much for us to adapt ourselves to the new conditions that have arisen, and to ensure that the efficiency of the Regiment does not suffer through lack of readiness to march with the times. Only by following where duty leads can we maintain the renown won at such cost in the last war.

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SOME ASPECTS OF GREAT CAMPAIGNS.

II.—1914 in the West. (Concluded).

By Major R. G. Cherry, M.C., R.F.A.

THE first phase of the struggle in the Western theatre of the Great War may be said to conclude with the German retirement to defensive positions north of the Aisne, and thence north of Rheims, Suippes and Verdun.

German strategic objective after the Marne.

Their main strategic object in this first period, was, as has been shown, the destruction of the French armies. Foiled in this object by the superior strategy of the French Command, they were forced to conceive a new plan of campaign.

Their new objective was to secure as much as they could of the territory they had overrun, and in particular to seize the Channel ports, and establish a line from the mouth of the Somme, or even further south, across Northern France.

This new blow was then primarily aimed at Britain, though the elimination of the Belgian fighting forces, and the possession of their manufacturing districts, and the rich French industrial country round Lille, also formed a subsidiary part of their scheme.

The eventual development of the submarine menace and of aircraft bombing raids on England, both of which were based on the German possession of the Belgian coast, indicate what Britain would have suffered if the Allies had been unable to keep the invader from the Pas-de-Calais. Not only would the maintenance of large British forces in France have been rendered most difficult in the face of submarines and aircraft based on Calais, but the threat of invasion of the Kentish coast would have kept large forces for home defence. In fact invasion, under cover of submarines, aircraft and heavy guns, might well have occurred.

End of German retreat.

The end of the German retreat and the beginning of the long series of battles known as the Battle of the Aisne dates from September 13th, on which day the allied advanced guards were brought up against, and stopped by, the positions the Germans were entrenching on the north bank of the Aisne, and thence along what became the Western Front to Verdun.

On the Eastern portion of the front from Verdun to the Swiss frontier, the French moved forward in Lorraine up to the German frontier, and secured the passes in the Vosges, but no strategic advance was made in this theatre. The known strength of the

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German defences that covered Metz and Strassburg would have called for the employment of large forces which were required to form a reconstituted army to strengthen and prolong the allied left.

The German forces were enabled to stand on the line they selected by the excellent defence put up by their rearguards, who were the first to demonstrate the efficacy of machine guns used in large numbers to cover a retreat.

At the same time their retirement in certain localities was pressed further than they had intended, and these places, such as Soissons, Reims and Suippes were to be made the objects of counter-attacks in force.

Severe fighting took place during the next few days in front of the German defensive positions, with the general result that both sides became practically immobilised and lay, strongly entrenched, facing each other.

German plan of action.

The next action by the Germans should have been to concentrate at once all their available cavalry on their right wing, and boldly push them west on Amiens and Abbeville with a view to securing the line of the Somme. The small French detachments of territorials based on Lille, Calais and Dunkerque in the north could have been masked and, later, dealt with by mobile mixed detachments. The Germans were, however, overcautious and having nearly suffered complete disaster through neglecting their exposed wing on the Marne, were determined to take no chances. They, therefore, tried to overlap the French left, at first with local reserves, and then with their 6th army under the Crown Prince of Bavaria which was moved round by rail from Lorraine. This army deployed to the right and tried to outflank the French left on the line Noyon—Peronne. Here, on September 28th, they met Castlenau's re-formed 2nd army which Joffre had concentrated at Beauvais in anticipation of this move.

French plan.

The French plan of campaign, after it became evident that their opponents were going to stand on their selected positions, was clearly defined. It was no use trying to force a way through the defence by costly frontal attacks against an enemy strongly entrenched and superior in numbers; both sides had found that the eastern frontiers were too strongly fortified to allow a decisive success there, and the need to relieve the beleaguered Belgian field army was pressing. Joffre, therefore, had as his ultimate aim a prolongation of the existing line to the line of the Scheldt as far as the Dutch frontier. This would secure the whole of the French and Belgian coast and would include the important industrial centre of Lille. In the prosecution of this plan Joffre was hampered by his inferiority of numbers, by having to send troops round the circumference of a circle while his opponents could send them radially, and by the necessity of keeping sufficient forces on the rest of the front to withstand attacks that might develop into serious menaces to important parts of the line.

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German counter-attacks.

Actually two distinct series of German counter-attacks took place, the first being made with the object of improving their front by the inclusion of ground of importance, and the second with the object of pinning down a large number of effectives to the stabilised front while the outflanking movement was taking place.

As regards the former attacks, they can again be sub-divided into actions on the Aisne or Suippe fronts, and attempts to isolate Verdun.

For these counter-attacks and for their enveloping movement the Germans were re-inforced by twelve army corps, while; as against this, they transferred one infantry and one cavalry division to the Russian front.

Attacks on the French centre.

As soon as the allied assaults on the main German positions had ceased, German counter-attacks were made on Manoury's 6th Army and on the British on his right. These attacks reached their climax on September 20th and made practically no progress. Further to the right the French 5th Army lost some advanced positions about Craonne but inflicted a severe defeat on the Prussian Guards at Berry-au-Bac.

Direct attacks against Reims only resulted in the capture of Fort Brimont from which place artillery fire was brought to bear on the town, while an attack on Auberive ended in disaster to the Germans, whose leading division was annihilated.

Attacks round Verdun.

The attempts to isolate Verdun were more serious; owing to the withdrawal of Castelnau's army, a gap was left between Sarrail's right and Dubail's left near Pont-a-Mousson. In this gap lies the Woeuvre plateau, which was watched by two territorial battalions based on St. Mihiel. A quick dash by the Germans could have secured the crossings of the Meuse at once, and would have carried them to the Aire without opposition. They missed their opportunity through being too cautious, and even then, their methodical attack against the minute covering force carried them over the Meuse and halfway to the Aire. By that time, however, Sarrail attacked with his right, while three divisions were hurried up by Dubail from Toul. By hard fighting the Germans were driven back to St. Mihiel where they held on to the bridgehead and the Woeuvre plateau until the last months of the war.

Another German attack was made on Sarrail's right when the Woeuvre attack had been launched. This attack had as its immediate objective St. Menehould railway junction, and was planned to link up with the Woeuvre attack and thus isolate Verdun completely and with it the bulk of Sarrail's army. It had some initial success, but was not pressed when the situation at St. Mihiel was restored by the French.

On the French side, offensive movements were, after the first few days of the battle, confined to prolongation of the extreme left, and a cavalry raid round the left flank against the German com-

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munications about St. Quentin on September 17th. Very severe fighting followed the encounter of the rival outflanking armies on September 28th and the following days. The Bavarian army pivoting on its left struck the French left on the Somme, and inflicted a severe defeat on the Territorial division opposed to it near Bray. Seasoned troops, however, came up in support, and, driving the Germans back on Peronne, seized the high ground east of Albert, thus threatening the German right.

The second series of German local attacks extended over the period now to be considered, that is to say, the months of October and November: they usually coincided with important events in Flanders or Picardy, and will be mentioned in their place more as a reminder that the allied command had to maintain effectives on the whole front capable of dealing with such attacks, than for the tactical effect they had on the local situation.

Siege of Antwerp.

The check administered to the Bavarian turning movement by Castelnau, together with the very bold attitude assumed by the French detachments about Arras and Douai, made the German High Command turn its immediate attention to the Belgian army at Antwerp. Fearing relief by the allies, the Germans determined to reduce the fortress at once and to force the defending army to surrender.

The reduction of the fortifications could have been effected at any time after the failure of the Belgian sortie on September 12th, by siege guns released by the fall of Maubeuge which took place on September 8th. Time was, however, wasted in endeavouring to secure the submission of the Belgians by diplomacy, and the actual siege of Antwerp was not begun by Von Baeseler until Sept. 28th.

The outer defences were quickly demolished, and the Belgians, realising that the city would soon become untenable, prepared to evacuate it on October 3rd.

At this point, political interference with the leaders in the field nearly caused disaster. Joffre's plan was that the Belgian army should evacuate Antwerp when the pressure became too great, and before the Germans attempted to invest the town from the north bank of the Scheldt. They were then to fall back along the north bank until touch was obtained with the allied left. To assist in effecting this junction the British 7th Infantry and 3rd Cavalry Division were ready to leave England and could be landed at Boulogne or Dunkerque. The British Naval Division had already landed at Ostend, and a French brigade of Marines was marching from French Flanders on Ghent, while a French territorial division was forming about Cassel.

The British Government, however, considered that the political importance of Antwerp was so great, and the moral and actual effects of its surrender would be so disastrous, that they persuaded the Belgians to hold on to the town, and promised them efficacious and early support. Actually the Naval Division was sent to Antwerp, while the other British divisions landed at Zeebrugge and Ostend on October 6th and 7th.

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The Belgians were unable to hold out after October 8th, on which day the evacuation began. Thanks to the overcautious and incomplete way in which the Germans set about the investment, the bulk of the Field Army was able to make its escape, but the rear-guard suffered very heavily, and a large proportion of one of the British naval brigades, besides most of the fortress troops, were forced to cross the border into Holland.

The troops from Zeebrugge and Ghent were very useful in covering the retreat, but they would undoubtedly have been much better employed at an earlier date in making good the line of the Scheldt between Ghent and Lille, while the Belgian army was extricating itself with forces intact, as it could have done on October 3rd.

Antwerp surrendered on October 10th and the Belgian army made its way to the Yser, behind which river it halted in a somewhat tired and dispirited condition, and short of guns and ammunition.

Transfer of B.E.F. to Flanders.

Meanwhile the rival outflanking movements were extending over Picardy and Flanders.

On September 29th Sir John French asked for the transfer of the British force to their original position on the left of the line. The advantages of such a move were explained; the long line of communications through central France to St. Nazaire would be replaced by very much shorter lines from Abbeville or Boulogne, which would be more convenient for the British and would ease the strain on the French railways: greater facilities would be given for the uniting of all the British forces in France, which forces would then have more freedom of action strategically, and could use more initiative. Joffre concurred, and the move was gradually and skilfully effected during the early days of October. The cavalry, now expanded into a cavalry corps of two divisions, moved by road to join Conneau's French cavalry on the left flank, while the 2nd corps were withdrawn from the Aisne positions and moved by rail to Abbeville by October 9th. Their place in the line was filled by extending the fronts occupied by the 1st and newly formed 3rd British corps.

The last to move was the 1st corps, when the whole original British front was taken over by the French armies on their right and left. To cover the withdrawal, strong local attacks were made on both flanks. The British divisions, as they detrained, were marched to prolong the left of the new French 10th army, which, under General Maudhuy, had itself prolonged Castelnau's left about Albert to La Bassee.

Outflanking movements to the North.

Undoubtedly the allied movements in the north at the end of September, which were from now onwards co-ordinated and controlled by Foch, imposed an excess of caution on the German Command, as the French were able, in spite of their inferior communications, to keep pace with the expansion of the German right wing.

The Bavarian army gradually moved north, being relieved by

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Bulow's 2nd army, which, on October 3rd, made a violent attack on Castelnau at Roye, capturing the town but suffering very heavy losses from a French counter-attack. Simultaneous attacks were made in the Woeuvre and in the Argonne, attempts to cross the Meuse and to threaten Sarrail's communications; also in Lorraine and the Vosges, demonstrations were made by weak forces, which actually resulted in the French gaining ground. All these attacks were made with the strategic object of pinning down French divisions and hindering their movements on the northern wing.

Meanwhile Maudhuy's 10th army detrained at Amiens and prolonged Castelnau's left to La Bassee.

Cavalry actions in Flanders.

It was at once attacked fiercely by the Bavarian right, while at the same time the German cavalry was launched in force along the Lys in a belated attempt to seize the coast.

This move was at once countered by Conneau's cavalry, and heavy fighting on a big scale ensued between the mounted troops, which was decided on October 11th in favour of the French who forced their opponents to fall back south of the Lys on to what was later to become the British front in that theatre.

On the same day the British Cavalry came into action, cleared the Nieppe Forest and then swept across the Flanders plain.

On the 12th the important strategic pivot Mont des Cats was captured by the 2nd Cavalry Division who on the following day drove the German cavalry from Mont Kemmel and the neighbouring hills. On that day the British 3rd Corps drove the enemy out of Bailleul and Meteren, while the 2nd Corps on Maudhuy's left was well east of a line Bethune—Merville, with French cavalry between it and the 3rd Corps.

The Belgian army was meanwhile retreating to the line of the Yser, behind which it withdrew on the 15th: its retreat was covered by the French Marines, who then took post at Dixmude, and by the British 4th corps (7th Infantry and 3rd Cavalry divisions) who on the 15th were several miles east of Ypres.

On the German side, behind the covering forces of cavalry and jaeger detachments that were being pushed back as stated above, the Duke of Wurtemburg's army had been taken out of the line and was concentrating in the area Lille—Tournai, while Von Baeseler, following up the Belgians, had by the 15th reached a line Ostend—Thielt.

The German cavalry and air work during the first fortnight of October was very far from good: not only had they failed to find out the strength of the allied troops that had now barred their way to the Channel ports, but they failed also in discovering the allied weakness between the Lys and Ostend.

A swift movement north-west from Courtrai about October 10th might well have led to the crushing of the Belgian left before it reached the Yser, and would probably have resulted in the isolation of the British 4th corps and the French Marines.

Their failure to seize their opportunity reflects all the more

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credit on the allied leaders who, by showing a bold front with small forces, deceived the enemy as to their lack of strength.

The failure of the Allies to reach the line of the Scheldt was due, apart from political interference, to their numerical inferiority, and their inability to spare enough men from certain vital and threatened parts of the line.

The German failure to reach the French coast was not due to lack of men: in fact at this period there were so many troops, principally newly raised formations, in the northern theatre of operations that there was serious congestion north of Lille, and the movements of Wurtemburg's left interfered considerably with the communications of the Bavarian right.

Battles for the Channel Ports.

The fierce battles that ensued, when the German masses deployed, may be considered in regard to the thrusts that were made in strength against certain parts of the allied line between the Somme and the sea.

Simultaneously with these thrusts, pressure was exerted against practically the whole of this line. The Allies, being in a numerical inferiority of about 4 to 6 on this line, were compelled to act on the strategic defensive, although in the opening stages of the battle, the tactical offensive was assumed in order to secure important positions and in order to deceive the enemy as to the allied strength.

Yser thrust. October 15th—29th.

The first thrust against the Belgians and their French supporting troops was made by Baeseler's Antwerp army in an attempt to drive them from the line of the Yser, and so to turn the Allied left.

Success here would have compelled the retirement of the allies and would have given the Germans Dunkerque and perhaps Calais.

As the German advanced troops approached the Yser on October 15th, they were attacked by a Belgian brigade and the French Marines east of Dixmude, while French and Belgian cavalry seized the Houthoulst Forest, threatening Baeseler's left flank, and forming a screen in front of Ypres. At the same time, the British 4th corps assumed an offensive attitude towards Roulers and Menin. This made the Germans hesitate and gave time for the Belgians to organise their defensive positions and for D'Urbal's new 8th French army to concentrate in French Flanders. On October 19th the Belgians were attacked at Nieuport, while the French and Belgian cavalry were pushed back to the Forest. On the 21st the British 1st Corps came into line, and, advancing from Ypres to the north-east of the town, occupied a line Bixchoote—Zonnebeke while French Territorials carried the line to the Canal. This offensive attitude made both Baeseler and Wurtemburg's leading corps at Roulers believe that the Allies were in strength about Ypres, and their attacks on the Belgians were not pressed home until they had, as they believed, checked the allied threat to their right.

Their first attacks on the British 1st Corps were made with this object on the 22nd. The ease with which they cleared the Houthoulst forest and held up the British made them realise that the allied forces were not strong in front of Ypres.

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The above constitutes a striking example of the value of the tactical offensive to conceal weakness, and the effect of the threat on their flanks to German commanders smarting under their defeat on the Marne.

On the 24th, units of the 8th French army came up, some to reinforce the Belgians and others to take over the defence of Ypres on the north-east, while the British 1st Corps took ground to the right and got in touch with the 4th Corps on the Ypres—Menin road.

By this time, four German corps had deployed against the Yser front between Nieuport and Dixmude, and these two places, together with several *points d'appui* between them on the east bank were assailed violently between the 23rd and the end of the month. British monitors, operating off the coast, were able to assist the northern flank with heavy gun fire and repel the attacks on Nieuport.

Further south, the Germans succeeded in crossing the Yser, and advanced to Ramscapelle and Pervyse where they were held with the help of French reinforcements.

On the 30th, when the hostile attacks began to slacken, the Belgians opened the sluices and flooded the country, compelling the Germans to withdraw to the east of the flooded river with heavy losses in guns that they were unable to remove. The Belgian army was thus enabled to rest and refit while the Germans concentrated their efforts on the allied line south of the floods. This delay in opening the sluices (which might have been carried out on October 15th) was a strategic move on the part of Foch, who was especially anxious that the spearhead of the German attack should not be directed against the Ypres positions until the allies were sufficiently strong to hold them.

Thus it was that the bold attitude of the British, the stout defence put up by the Belgians and their French supports, and the masterly strategy of Foch, enabled the Allies to fill the gap between the Yser and Lys and bring reinforcements within reach, should parts of that front be unable to stand the severe strain that was expected.

Again had German reconnaissance failed to discover the allied weakness at a spot where a determined thrust might have produced decisive results.

Arras thrust. October 18th—26th.

The battle that took place between Lens, and south of Arras was an attempt to break through to the coast between Montreuil and Abbeville, and thus to cut off the allied left wing, which was being heavily engaged on the whole of its front.

In these attacks some of the best German troops, including a division of Prussian Guards, were used, and the operations were considered by the French and German High Commands to be of critical importance.

On the 19th Lens was seized, and in hard fighting during the next few days the French were driven from the Vimy ridge and Lorette spur, while Arras was being encircled from north and south. On the 24th the battle reached its climax in a desperate attack on Achicourt and the southern outskirts of the town. French reinforce-

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ments held up the attack, and on the following day Maudhuy assumed the offensive and drove the Germans back from their advanced positions. The battle died down on the 26th, when the Guards were removed to reinforce the German right.

Ypres—Armentieres thrust. October 27th—November 12th.

The third and final thrust was made by the armies of Bavaria and Wurtemburg against the British front between La Bassee and Ypres. Simultaneously attacks were made on the stabilised front in order to divert reinforcements from the critical northern operations.

A surprise attack made by a corps north of Rheims was repulsed with loss on the 27th: on the same day Bulow's 2nd army assumed the offensive in the neighbourhood of Chaulnes, but was repulsed by counter-attacks which gained ground near Chaulnes and south of the Oise.

A more serious offensive was taken by the German 1st army on the Aisne. After several days fighting the French were on November 3rd forced back to the river on a wide front, and in places to the slopes on the south bank. Four days later, a French counter-offensive restored the situation, recovered most of the lost positions, and made ground north of Soissons.

Turning back to the Flanders fighting: the British had suffered heavy losses during the fighting in the first three weeks of October, and had only one division of the Indian corps in reserve.

On the other hand, the Germans had been heavily reinforced and by the end of October had 12 corps between La Bassee and Dixmude, opposed to 7 corps of the Allies. Of these 12 corps, five were massed between the Lys and the Ypres—Menin Road. On the 27th the British line in this area was held as follows: Cavalry corps (3 divisions) Messines—Zandvoorde. 1st corps and 7th Division astride the Ypres—Menin Road to Zonnebeke, where they were in touch with the French 9th corps of the 8th army. On October 28th a strong attack on the British 2nd corps resulted in the capture by the Bavarians of Neuve Chapelle, an important *point d'appui* in the line. The second corps were then relieved by the Indian corps, and brought into reserve.

On October 29th the main attack opened against the British positions on the Ypres—Menin road while the cavalry were forced back by vastly superior numbers, on this and the following day.

October 31st was a critical day: the attacks on the cavalry front were resumed, and British reserves had to be thrown into the fight to maintain the front.

At mid-day the 1st corps who had maintained their positions during the previous fighting, were subjected to massed attacks supported by heavy artillery.

Their front was broken at Gheluvelt, and was only recovered by a bayonet charge of the last reserve.

On the following day the cavalry front was broken and the Wytchaete ridge was captured by the Germans, but by this time the French 16th corps with a cavalry division had begun to arrive, and counter-attacked just in time to save the Mont Kemmel position, which was the key to the defence between Ypres and Armentieres.

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The final effort was made on November 11th by fresh German troops of which the Prussian Guards were the pick.

The main attack was preceded by a strong attack against the French positions at and south of Dixmude. The German plan was to draw the allied reserves towards Dixmude, and then launch a series of massed attacks against the British 1st corps front. If this corps were driven back through Ypres, as expected, their retreat would be threatened and perhaps cut off from the north.

In this northern attack, the Germans succeeded in capturing Dixmude and in crossing the Yperlee Canal near Nordschoote. They were, however, held and then driven back over the canal by a counter-attack made by a French colonial division, whilst an attack made by them on Bixschoote failed completely.

On November 11th the main attack was made in mass against the front of the French 9th corps and especially along the Ypres—Menin road.

By its weight, it gained initial success, and broke through the front north of the road. The allies had, however, expected the attack which was decimated by artillery fire, and then thrust back by counter-attacks with the bayonet.

This was the last dangerous attempt at forcing his way through the allied left wing, and this part of the front became stabilised. Siege warfare supervened and the Germans transferred large numbers of their best troops to the east, replacing them with second line units.

Comments. Use of Fortresses.

This campaign affords several examples of the use and value of fortresses in modern war, but the scope of this essay does not permit of more than a rough survey.

Of the fortresses that figure in the operations, it will be noticed that Belfort in the south served the double purpose of forming a strongly fortified defensive position in the small gap between the Vosges and Swiss frontier, and an obstacle within which the French were able to concentrate and deploy forces for their offensives into Alsace in the early days of the campaign. The rôles of Epinal were to serve as a *point d'appui* for forces acting in the Vosges, and as a southern pivot of manœuvre against hostile forces that might attempt to force the gap of Mirecourt.

Toul served as a support to the entrenched positions on the Couronné of Nancy, and also as a pivot of manœuvre from the north protecting the gap of Mirecourt, and from the south protecting the crossings of the Meuse to Verdun.

It will be remembered that the German attack on St. Mihiel and the crossings of the Aire was checked and driven back by troops acting from Toul.

Verdun, the strongest and most prominent of all French fortresses, not only acted as an entrenched camp forming a *point d'appui* against invasion from Metz to the Ardennes, but acted as a pivot of manœuvre on which the French right flank rested on the battle of the Marne. The efforts made by the Crown Prince, during the French retreat, to invest Verdun showed the importance attached to its possession.

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It will also be noticed that all the above named fortresses, except Belfort, are astride rivers that traverse to the line of operations of the invader, and thus obtain greater strength. For instance, an army which had forced the Moselle between Toul and Epinal, would under modern conditions of long range artillery and bomb dropping aircraft, find its communications over the river greatly constricted and insecure, until these fortresses had been reduced.

Turning to the Belgian frontier, the fortress of Liege, which was not up-to-date, served indifferently its purpose of delaying the German advance, and considering the ease with which the Germans reduced Namur a few weeks later, and the more powerful Russian fortresses in the following spring, it may be assumed that they could have compelled the surrender of Liege at once had they wished it, by the immediate production of their powerful siege ordnance. The German delay in approaching Namur, imposed on them by their strategic plan, permitted Lanrezac to use and amplify the fortifications of Namur as a bridgehead for offensive action on the Sambre and defensive action on the Meuse.

As it was, however, it was only garrisoned by Belgian troops in its out-of-date rôle of fortress, and was not used as a *point d'appui* or pivot of manœuvre. Moreover it was not built to withstand modern heavy artillery and was, therefore, reduced with the greatest of ease.

Maubeuge, another second class fortress, served as a useful *point d'appui* for the French left wing at the battle of Charleroi. It was a dangerous attraction for the exposed British army, threatened with double envelopment at Mons. Sir John French, remembering the example of Metz in 1870, wisely refused to be tempted to withdraw his troops into this fortress, which became useless after the allied retreat, and was promptly invested and within 14 days captured.

The use of Antwerp, which was used as a base of operations for the Belgian army, is an example of the lure of a fortified town that has immense commercial and political importance.

As the mouth of the Scheldt belongs to Holland, no reinforcements could be expected by sea, nor would the capture of the city be of military importance to the enemy. Had the Germans conducted their operations against Antwerp intelligently, they could have seized the crossings of the Scheldt above the town and compelled the surrender of the field army.

The selection by Belgium of a base and line of operations that was isolated from her allies was strategically unsound, and indeed formed a dangerous lure for the French General Staff.

A better line for the Belgians would have been a line covering Ostend and Bruges to the Dutch frontier, which would have given security to both flanks, and have enabled reinforcement or withdrawal by sea.

On the German side, the only fortresses that need be considered briefly were Neu Brisach, Strassburg and Metz. The former acted as a rallying point for the German troops defeated in the early Alsace offensive, and as a point of concentration for the army which defeated the French at Mulhausen in the first offensive. Metz and Strassburg secured the flanks of the last defensive line in Lorraine which Castelnau failed to pierce on August 20th. Metz also acted

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as a pivot of manœuvre for the army operating against the Couronne of Nancy.

Command of the Sea.

The possession by Britain of the command of the sea, enabled her to land troops at any selected point on the French or Belgian coast, to maintain uninterrupted communications with these troops, and to change her sea bases and lines of communications from the northern French coast to the Bay of Biscay, when the latter were threatened by the German advance to the Marne.

Influence of Forests.

The use of forests for concealment of strategical concentration and tactical manœuvres is most important, especially in view of the reconnoitring powers of aircraft. Note should be taken of the screen afforded by the Ardennes to the secret concentration of Hausen's army, and to the deployment of Hausen and Wurtemburg's armies against Langle and Ruffey on August 21st.

The Argonne forest enabled Sarrail in the early days of September to manœuvre with decisive effect against the superior forces of the Crown Prince.

Rivers.

The high standard of excellence reached by the engineering services of modern armies has tended to reduce the influence of rivers on the conduct of a campaign.

From having had in the past an immense strategical importance, they became on the whole merely adjuncts to tactical resistance. At the same time, it must be remembered that the main strategic moves took place in the early autumn when the rivers were low.

The misuse by Lanrezac of the Sambre and the Meuse salient has already been commented upon. During the retreat neither the Oise, Aisne or Marne had more than a temporary delaying effect on the advanced guards, and in the allied advance, the Aisne was crossed by both British and French in spite of hostile fire, broken bridges and a depth of 25 feet. The one striking use of a river was the flooding of the Yser on October 30th.

Novel features.

Certain novel features should be noticed, such as: the effect of motor transport in diminishing the strategic importance of railways, and in enabling—to a limited degree—the rapid transport of troops in the attack and defence.

The effect of aircraft reconnaissance in discovering concentrations: the limitations to strategic manœuvre imposed on Commanders by the masses of men employed in a restricted theatre: the effect of a (militarily) uneducated allied press in issuing misleading critiques on the conduct and results of the campaign.

Comments on German failure.

As the Germans had failed to attain their first strategic objective, the destruction of the allied armies, through over confidence and

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neglect to secure their exposed flank, so they failed to attain their next objective through excess of caution to which may be added lack of initiative, and faulty reconnaissance.

No greater proof of their severe strategic defeat on the Marne can be shown than the change from confident and forceful conduct of their operations up to September 6th to the halting, ponderous and careful extension of their right wing at the end of the same month and in October.

If a north and south line be drawn from that point on the Oise, which marked the outside flanks of the opposing armies in mid-September, to the North Sea, it will be found that the front stabilised by the end of November is barely west of that line. This means that, in spite of numerical superiority and concentric lines of communications they barely had the advantage from a territorial point of view in the struggle for the coast.

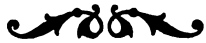
From a strategic point of view their failure was infinitely greater than that of the allies, who were not playing for such great stakes, and who had achieved their object, the safety of the Belgian army. The extent of the German failure should be considered firstly from the point of view of the war as a whole.

Not only had they, in four months of war, failed to crush their western opponents, but they were pinned down by them in positions that were not of their own choosing, unable to advance and afraid to go back.

Meanwhile, Russia had inflicted on Austria defeats and losses that were on a hitherto unprecedented scale, and had won battles compared to which the tactical German victories in Lorraine and Charleroi were as skirmishes.

From the local strategic point of view, the Germans had now failed to secure the coveted Channel ports, with the exception of Zeebrugge and Ostend. Instead of Britain being menaced and within range of their big guns, she was now able, and was obviously going to pour reinforcements into Flanders, to create new armies and move those armies behind the narrow strip of water between Dover and Calais that could be made practically impenetrable.

From the tactical point of view, she had incurred immense losses of some of her best troops: unable to gain even momentary successes unless in superior numbers and backed by superior shell power, her cavalry arm a failure in the attack, in mobility, and in reconnaissance. From her leaders down to the rank and file, lacking in initiative her troops were man for man inferior to the opponents they had confidently expected to overwhelm.



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INFANTRY GUNS; WHEELS OR PACK?

By Bt. Lieut.-Col. G. P. MacClellan, D.S.O., R.A.

[Some readers may think that in view of the probable advent of tank artillery the following article is out of date.

As however there are two Mountain Artillery Brigades in the United Kingdom the Committee think it would be a mistake not to take stock of their capabilities in this respect and therefore publish the article.—Ed.]

ALTHOUGH the infantry as a whole are apparently satisfied with, or resigned to, the amount of assistance which they get from the artillery in active as distinct from trench warfare, still there appears to be an uncomfortable feeling in some quarters that they do require more support, particularly in dealing with machine guns, than can be afforded them by the present field artillery equipments. In some Divisions in France an attempt was made to provide this support by making mobile the trench mortars for moving warfare, but with only, it is believed, indifferent success. Whether, however, the solution of the problem be sought along the lines of guns or of mobile trench mortars, and whether the weapons be manned by the Royal Artillery, by infantry personnel, or by a special new corps, the question of pack or wheels remains the same.

The troubles of the infantry in a full dress attack during the late war were caused again and again by their being temporarily held up by some strong point or points, or possibly by one trench, and by their inability to hold back the barrage until they were ready to go on again; having once lost the barrage they had then either to reduce the strong points and to complete the rest of the attack entirely unhelped by the artillery, or else to remain where they were; if they were able to do the former they suffered very heavy casualties, if they were compelled to do the latter another battle for the same ground became necessary. In more open warfare they were frequently confronted with the same sort of obstacles, sited so as to present the maximum of difficulty to field artillery in its efforts to deal with them. Unless the future has in store some new and vastly improved method, at present hardly dreamt of, of directing artillery fire from a distance extra assistance can only be given by guns (in which term is included howitzers and mortars) in close company with the infantry.

During the late war, on the Western Front, in the big attacks made from what had become our permanent positions e.g. the Somme Offensive of 1916, and the Ypres Offensive of 1917, practically no attempt was made to provide this special form of artillery assistance, the reason no doubt being that the shell-plastered areas were practically impassable by field artillery for purposes of manœuvre. In moving warfare the approved method was to push up sections or single guns, but it was not an unqualified success; in some parts, over particularly favourable ground, field guns did get well up and

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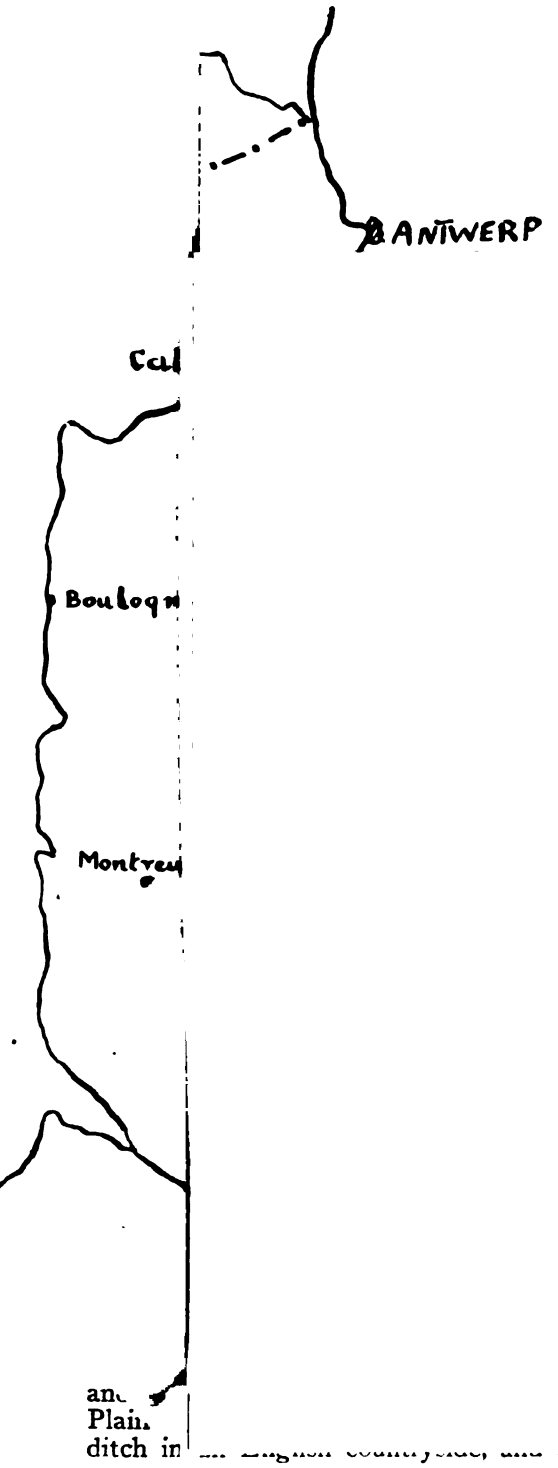

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ularly favourable ground, field guns did get well up and

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did good service, but in many other parts they failed to do so, and the infantry were left to work out their own salvation.

Two methods of getting guns up have recently been discussed in the R.A. Journal. The first article advocated the provision of a new type of small gun to go in draught with a reduced team; the second the employment of pack, or mountain artillery.

What constitutes the special work of guns in close support of infantry is well known, and need not be reiterated here except in so far as to emphasize that the need of them is very largely due to the fact that guns are the best antidote to machine guns.

The author of the first of the two articles referred to above ruled out pack artillery for the purpose, without however adducing a single reason for his opinion; neither did he give any indication as to what his experience of that branch of the Regiment had been which enabled him to be so positive on the point. Captain Pemberton's reply on the subject of the ballistics, and of the quickness of coming into action of mountain artillery, appears to dispose fairly effectively of any objection on those grounds. It is proposed now to compare pack and draught as regards mobility for the particular purpose of infantry guns.

It is submitted with some confidence that two essentials for such guns are (a) that they should be able to accompany infantry wherever they go; and (b) that they should for purposes of manœuvre be as mobile as the nuisances which they are primarily out to crush viz. the machine guns, which are so usually in pack. To get guns which perfectly fulfil requirement (a) is in this imperfect world unfortunately impracticable; pack artillery however is capable of going wherever infantry can walk without requiring to use their hands to help them, i.e. on any ground which is not practically precipitous; the same cannot possibly be said of any guns, however handy, which are equipped for draught only. An unfordable and unbridged stream or river will in the absence of pontoons hold up wheeled guns where pack guns and ammunition can be easily taken across in pieces in a small boat or on an improvized raft, and the mules can be swum across. On one occasion in the writer's own experience in France field artillery were held up for hours for want of a bridge when pack artillery could have crossed by a footbridge which had been left intact, in proof of which it may be stated that the Brigade Headquarter horses did cross by it.

The advantages of pack over wheels were universally recognized on the Somme in 1916, and at Ypres in 1917; in both areas, once the ground had become bad, ammunition, both artillery and infantry, water, rations, in fact everything (except guns) required anywhere near the front line was sent up in pack; and indeed before the war, even, the advantages of pack with infantry was so far recognized that they took no wheels with them into action, but did take machine guns and S.A.A. in pack.

Wheels score on roads; deny them the roads, as roads usually are denied them at close range in war, and they become less mobile and less elastic than pack in almost any country other than Salisbury Plain and the like. Take a very ordinary stiff hedge and largish ditch in an English countryside, and compare the time required to

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make a gap in the former and a causeway in the latter passable by a single animal with the time required to make them both passable by a wheeled piece and its team; there is not the least doubt as to which scores here. Again, plough in wet weather is killing work for 18-pdrs. or for any wheels; it is a strange field where there is not a track either across or round the edges which is quite firm enough for the loaded mule. For night operations across country, and for work in woods and marshy ground where narrow and winding paths have to be negotiated there is only one thing in it, and that thing is pack.

As against all this there does not appear to be much to be said in favour of a new type of gun on wheels. It would probably be slightly quicker at coming into action, and would probably fire a slightly heavier shell, but it is surely preferable to sacrifice a good deal in these respects for the practical certainty of being able to go wherever required, and it is at least open to question whether weight of metal is of very great importance; a small gun where it is wanted is certainly worth several larger ones which cannot get there.

It is perhaps unfortunate that no real opportunity was ever afforded pack artillery on the Western front of showing what it could do. There were only 3 batteries which arrived on the scene when trench warfare had already set in, quite the most unfavourable conditions under which infantry guns for mobile warfare could possibly work, and they left before open warfare re-started. Nevertheless at Neuve Chapelle pack guns were in action in the village and at Loos on Fosse 8, on each occasion far in advance of any wheeled artillery. (So, at any rate the writer has been informed by members of the pack artillery brigade in France).

It is surely unsound to pass an adverse judgment on their utility because a very few pack guns failed to turn defeat into victory on occasion when very many times as many batteries of other kinds failed to pave the way to it. The significant fact, it is maintained, is that under such unfavourable conditions as obtain in an unsuccessful battle in trench warfare guns were brought into action almost in the infantry firing line; and it is legitimate to speculate as to whether such mobility under fire might not have been turned to useful account in more successful actions later on in the war, as for example on the 31st July 1917, when the 51st, 38th and Guards Divisions having reached the Steenbeek without excessive difficulty were unable to advance further as by doing so they would have placed themselves beyond the reach of effective artillery support owing to the field batteries, with very few exceptions, being unable to cross the old Boche front line for a very long time, an obstacle which would not have troubled pack artillery very much.

In the final operations of the war in the writer's own limited experience on three occasions were the field artillery held up for hours by obstacles which would have caused pack artillery no anxiety, with the result that the infantry were for a long time fighting alone.

It is not argued that the present mountain artillery equipments are necessarily the most suitable for the purpose under discussion, it is quite conceivable that something more useful might be designed; but it is maintained that an equipment that can go both in pack and draught must be superior for the particular purpose to one which is prepared for draught only.

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ARTILLERY AT ANZAC IN THE GALLIPOLI CAMPAIGN,
April to December, 1915.

[The following correspondence is published in connection with a lecture on "Artillery at Anzac in the Gallipoli Campaign" reported in the R.A. Journal, March, 1920.

An interesting letter written by Sir C. Rosenthal in May, 1917, on the creation and development of the 4th Australian Divisional Artillery is also published.]

Sydney, N.S.W.,
Australia.
4th June, 1920.

THE SECRETARY,
The Royal Artillery Institution,
Woolwich, S.E. 18, London, England.

Sir:—

I have just had an opportunity of reading the Report of the Lecture given by Brig.-Genl. C. Cunliffe Owen, C.B., C.M.G., on January 22nd, 1920 (published in your Journal March 1920).

While generally the statements made are correct, there are two which are quite incorrect, and, in view of the weight naturally given to the address by General Cunliffe Owen, because of his official appointment with the Australian Troops, I should be glad if you could give the following remarks the same publicity as has been given to the lecture itself.

The Lecturer stated that the Australian gunners were untrained, had no regular officers but one, and that equipment was not up-to-date.

Regarding training. The first Australian Divisional Artillery was composed of at least 80% of well trained officers and men, training extending over many years, and very thorough in character. All officers in Australia in pre-war days had ample opportunity every year to shoot their batteries, ammunition allowance being very liberal. One battery of the 1st Brigade was composed entirely of regulars.

The one regular officer* referred to in the Lecture came to Australia shortly before the War as a Captain, with very limited experience, indeed, there were many officers in the 1st Australian Divisional Artillery who were infinitely better qualified than this regular officer.

The C.R.A., Gen. Hobbs, had over 20 years of artillery experience, had attended manœuvres in England on various occasions,

[*The officer in question afterwards when a Major and a/Lt.-Col. was appointed C.R.A. of one of the Australian Divisions at their request. ED.]

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and knew his job. Of the three Australian Artillery Brigade Commanders, Lt.-Col. Christian (later C.R.A. of 5th Australian Divisional Artillery) was a regular officer of 20 years or more experience. This officer had been attached to British Field Artillery at Okehampton in pre-war days in command of a British Regular battery, and did excellent work, which can be vouched for by Gen. Budworth, R.A. The other two Brigade Commanders were gunners of many years close study and experience, and early in 1916, were appointed C's R.A.

The equipment—far from not being up-to-date—was exactly similar to that used by British Artillery at the commencement of the War. The few small attachments added afterwards, as the result of Gen. Cunliffe Owen's experience in France, did not affect the weapons in the least, simply the safety of the crew.

While not wishing to discount Gen. Cunliffe Owen's services in Egypt during the final days of training, it can be truthfully said that the moving spirit was Gen. Hobbs himself, our own C.R.A., and to him the ultimate efficiency of the Divisional Artillery was undoubtedly due.

The General's remarks re. march discipline are quite uncalled for. For years before the War it had been the pride of the Australian Field Artillery—and justly so, that its march discipline was of the highest order. Dismounting at halts, and being punctual, far from being new ideas, had been diligently practised in Australia for years.

The second matter to which I wish to refer concerns the table on page 555. Here the General states that on 25th April, 1915, in addition to the guns of the Mountain Batteries, 4 guns of the 7th and 8th Australian Batteries (18-prs.) were landed.

Accuracy in this table is specially necessary, for much hangs on the actual hour of guns being landed.

All three Brigades of Australian Artillery had orders to disembark at a certain hour on the morning of 25th April, but shelling of transports from shore-batteries much delayed the process.

I personally reached the shore just before 1 p.m. on that memorable day and to my consternation was informed that no guns were to be landed, it being considered our footing on Gallopoli territory was too insecure.

Orders were sent to ships, cancelling disembarkation of guns, but already one gun of the 2nd Brigade was nearing the shore and this was allowed to land. Later in the day it did excellent work against guns located at Gaba Tepe.

Though I pleaded with higher authority to allow guns to come ashore, permission was refused. I urged that, as our infantry was committed we *must* support them with field guns, but I was informed it was considered unsafe to land guns.

I asked our Divisional Commander whether it was not better to risk losing guns, if by so doing we could save battalions, and, perhaps, even the whole position. Still permission to land guns was refused, and it was not till the morning of 26th April that guns actually came ashore on the Australian Section—a loss of 24 most precious hours—at a most critical juncture.

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I have written these line solely in the interests of accuracy, and I hope you will publish them.

Yours faithfully,
Charles Rosenthal, Major General,
Late C.O. 3rd Australian Field Artillery Brigade,
1st Australian Division.

Reply by Brig.-General C. Cunliffe Owen, C.B., C.M.G.

1. When I stated in my lecture that there was only "one Regular Artillery Officer" in the 1st Australian Divisional Artillery, I should have said "Only one BRITISH SERVICE, Regular Officer.

2. I quite agree with Gen. Rosenthal, that the moving spirit in the training in Egypt, and to whom thanks are due for the excellent results was Gen. Hobbs, the commanding officer of the Australian Artillery, whom I particularly quoted as "a most capable and experienced officer." I am the last person in the world not to fully appreciate the magnificent service of the 1st Australian Artillery. Their energy, capability, endurance, and general efficiency, were the admiration of all (myself included) from the beginning of their stay in Egypt, to the end of their long service.

The untiring way in which Gen. Hobbs, the three Brigade Commanders, Cols. Rosenthal, Christian, and Johnstone, in fact all the Australian Artillery Officers worked, with such excellent results, was apparent to everyone. The steadiness with which, through every difficulty, the Australian Artillery stuck to their job, in Gallipoli, and France, and their excellent shooting and service of the guns was proverbial.

With reference to the landing on the 25th April at Anzac, the table of dates is taken from a return, sent in by the 1st Australian Divisional Artillery at the time. According to the landing Orders, the guns of all three Australian Artillery Brigades were down to be landed early on the first day, and personally, I was most anxious they should do so, to support the infantry already landed. The late Maj.-Genl. Bridges, who commanded the 1st Australian Division at the landing, did not consider curcumstances permitted field guns to land till later, and some guns, as Gen. Rosenthal states, actually re-embarked after landing, by Gen. Bridges' orders.

There is no doubt, that, as Gen. Rosenthal states, one gun of the 2nd Artillery Brigade landed, amongst the first guns that came into action on the shore, and its non-inclusion in the statement is an error. I sincerely apologise to all ranks of the 1st Australian Artillery with whom, I was always on the best of terms, and for whom I have the greatest respect, admiration and affection, if any remarks of mine gave offence. After all we went through together, it would be sad indeed if any words of mine interrupted that harmony, or alienated any of my many Australian friends.

C. Cunliffe Owen, Brig.-Genl.,
late Brig.-Genl. R.A. Anzac Corps.

Lyndhurst, Hants.
12th August, 1920.

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FOURTH AUSTRALIAN DIVISIONAL ARTILLERY.

A Brief Outline of its History.

The creation of the 4th and 5th Australian Divisional Artilleries in Egypt early in 1916 was such an extraordinary and difficult task that it is desirable to record in brief their development. The task of forming the 5th Australian Divisional Artillery was akin to that of the 4th Australian Division, but as I am only familiar with the doings of the 4th Australian Divisional Artillery, I shall confine my notes to this latter Unit.

On the 17th February 1916 a preliminary Conference was held at the Office of the C.R.A. 1st Australian Division at Tel-el-Kebir, Egypt, at which the general outline regarding the formation of the 4th and 5th Australian Divisions was made known.

On the 21st February the C.R.A. of the 4th Australian Division was appointed and arrangements were made to transfer personnel from the 1st and 2nd Australian Divisional Artilleries to form the Divisional Artillery Headquarters Staff and one Brigade complete. This personnel was taken over on the 21st February. A further transfer of Officers and other ranks to assist in the formation of the remaining Brigades and D.A.C. of the 4th Australian Division was made on the 24th February.

About this time the establishment of a Divisional Artillery was altered and an extra Battery added to each Brigade. In view of this fact and also that the 1st and 2nd Australian Divisions were about to embark for France and could not build up to new strength before departure, I was ordered on March 2nd to hand back all the personnel and officers forming the 12th Brigade which had been handed over to me. I therefore only had left a small nucleus of officers and men —about 150—with which to commence the building up of the 4th Australian Divisional Artillery.

Instructions had been meantime issued by A.I.F. Headquarters that the necessary personnel to build up the new 4th and 5th Australian Divisional Artilleries should be drawn from Infantry, Light Horse and other Units, and soon this personnel commenced to come in—but very slowly.

In the meantime very little equipment could be obtained from Ordnance, as the 1st and 2nd Divisions—about to leave for France—were being first fitted out, and in addition, no horses were available excepting the few Officers' chargers which came over with the newly transferred Officers.

By the end of March the 1st and 2nd Australian Divisions had left for France. The 4th Division remained on temporarily at Tel-el-Kebir where suitable camps had been laid out, huts erected, water laid on, and where an excellent manœuvre area with gravel surface was available; but about 28th March it was ordered to Serapeum, on the banks of the Suez Canal, to take its share in the defence of the line at that point.

A special request was made to allow the Divisional Artillery to remain at Tel-el-Kebir, but this was over-ruled by G.H.Q. and the whole of the Artillery as then constituted, moved by rail to

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Serapeum, and pitched its camp in the midst of a sandy waste where empty vehicles could only with difficulty be drawn by the teams, and manœuvre was quite impossible. There the Division with its Artillery remained till ordered to embark for France on June 1st.

During the period at Serapeum, reinforcements were gradually being received, also a few horses, and suitable N.C.O's and men were being granted Commissions.

In addition to the gradual completion of the organisation of the Artillery, with the necessary drawing of Ordnance stores and the instructing of officers and men, tactical work had to be considered. Guns had to be emplaced for the protection of the Camp against aircraft, and on May 4th I was ordered to provide a mobile Column consisting of two Batteries with an Ammunition Column, to work some miles on the eastern bank of the Canal. This involved the fitting of all vehicles with sand tyres and the improvisation of special attachments to permit of 10 horse teams being provided (arranged as two leaders, 4 centre and 4 wheelers).

An ammunition dump also had to be provided some five miles forward from the Canal.

In addition to this work all Brigade and Battery Commanders were ordered to reconnoitre the country about six miles forward from the Canal, and select suitable gun positions for the defence of the forward line of resistance.

On May 8th elementary shooting for the Artillery was commenced and continued through most trying heat to 29th May—when packing was commenced for our move overseas.

On 28th May the composition of the 4th Australian Divisional Artillery was as follows:—

Artillery personnel	457
Light Horse	1198
Infantry	1171
Other arms	151
Total	2977

It will therefore be observed that at this date the proportion of Gunners to the whole Divisional Artillery was about 15%.

The composition of the Officers at this same date was as follows:—

GUNNER OFFICERS	24	Of varying experience from many years to a few months.
GUNNER OFFICERS ... ... (promoted from the ranks since formation of the 4th Aus. Divn.)	12	Of varying experience in the ranks from some years to a few months.
LIGHT HORSE OFFICERS ...	14	No previous Artillery experience.

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LIGHT HORSE OFFICERS (promoted from the ranks since formation of the 4th Aus. Divn.) ...	33	No previous Artillery experience.
OFFICERS OF OTHER ARMS ...	2	No previous Artillery experience.
Total	85	

Just prior to leaving Egypt the Brigade Ammunition Columns were abolished and a new establishment for D.A.C. laid down. This caused considerable delay.

Under instructions all transport vehicles with harness complete were drawn from Ordnance at Serapeum, and had barely been issued to Units when orders were received that they were to be left in Egypt, and in consequence had to be recalled and returned to Ordnance.

At the time of leaving Egypt the Division was several guns short and had only about one-fifth of its horses.

A further re-organisation was ordered at the moment of embarkation at Alexandria, the Howitzer Brigade being abolished and instead the Divisional Artillery to have four Brigades—each of 3 18-pdr. and 1 howitzer battery.

The necessary order for this re-organisation was prepared during the passage from Alexandria to Marseilles and was put into effect upon arrival in France.

On arrival at Marseilles early in June 1916 the Artillery was at once entrained for Havre, there to be finally equipped in material and horses. This completed, the Artillery was again entrained—this time for Caestre, in which area it had arrived by the 19th June.

On June 23rd orders were received to form four Trench Mortar Batteries from Artillery personnel—1 Heavy and 3 Medium.

This order had been complied with by the morning of the 25th June and personnel sent on 26th June to the T.M. School at Berthen.

A certain number of officers and part personnel of all Batteries were sent into the line on 21st June to learn the front.

On 5th July the 4th Australian Divisional Artillery took over from the 1st Australian Divisional Artillery in the Fleurbaix-Laventie Sector.

On the 13th July I handed over to the 5th Australian Divisional Artillery and the 4th Australian Divisional Artillery went out of the line.

The rest of the 4th Australian Division had moved South for the Somme offensive, but the Artillery not being considered sufficiently efficient, was ordered to a Training Camp in St. Omer Area.

On 14th July—owing to proposed operations against Fromelles—the 4th Australian Divisional Artillery was again ordered back into the line to assist the 5th Australian Division.

In the meantime all shell-proof pits had been occupied by the 5th Australian Division Batteries, so all the 4th Australian Division Batteries had to select positions under hedges, trees, etc., without any

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cover, and no communication established. As a consequence, their experiences till the operations were over on the 20th July, were very trying.

The work demanded of the Artillery for this operation was very exacting and it is almost impossible to realise that at the end of February (only 4½ months earlier) this Divisional Artillery was not formed, and when formed, only had 15% of Gunners.

The further services of the 4th Australian Divisional Artillery in the Ypres and Flers Sectors—as well as before Bullecourt—are well known and need no mention here: sufficient to say that during its service in France of about 11 months it has suffered in casualties:

Officers Killed	6
Officers Wounded	15
Other Ranks Killed	93
Other Ranks Wounded	232
Other Ranks Missing	15
Total	361

During its service in this country the 4th Australian Divisional Artillery has covered the Infantry of the following Divisions, and in each case has been complimented on its accurate and effective work:—

British	1st, 4th, 7th, 11th, 41st, 46th and 62nd.
Canadian	2nd and 4th.
New Zealand Division	
Australian	1st, 2nd, 4th and 5th.

It may be of interest to refer here to the creation and organisation of all the Australian Divisional Artilleries and by comparison to note the difficulties which beset the 4th Australian Division.

1st Australian Divisional Artillery:—

All Brigade and Battery Commanders were experienced officers and also all junior officers.

About 80% of rank and file were actually serving in Regular and Militia Batteries at the outbreak of war.

Lt.-Col. H. Dangar, Chief of Ordnance, Melbourne, who with his Staff created the 1st Divisional Artillery (and thus left the C.R.A. free to visit the different States and watch the building up of his Brigades and Batteries) was personally familiar with the qualifications of all officers and posted them to the best advantage.

One Battery was built up from the Regular R.A.F.A. Batteries in the various States.

The total number of Regular officers (R.A.F.A. and Duntroon Graduates) posted to the 1st Australian Divisional Artillery was 20.

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This Division had brought picked horses from Australia and had an excellent period of training in Egypt prior to the Gallipoli Campaign.

2nd Australian Divisional Artillery :—

Raised in Australia by the Defence Department and sent to Egypt complete, where its C.R.A. took it over as an established Divisional Artillery. The total number of Regular Officers (R.A.F.A. and Duntroon Graduates) posted to the 2nd Australian Divisional Artillery was approximately 18.

3rd Australian Divisional Artillery :—

Raised in Australia and taken over in England by its C.R.A.

This Divisional Artillery had a long period of training in England and had among its officers a number of Regular officers and Duntroon Graduates.

5th Australian Divisional Artillery :—

Created at Tel-el-Kebir, Egypt, under similar difficult conditions to that of the 4th Australian Division.

The number of Regular officers (R.A.F.A. and Duntroon graduates) posted to it on formation was approximately 12.

4th Australian Divisional Artillery :—

Created at Tel-el-Kebir, as set out in foregoing pages.

Not one Regular Artillery officer has at any time served with any Brigade, Battery, or the D.A.C. of this Command, and it is with great satisfaction that I am able today to look upon the present 4th Australian Divisional Artillery, efficient as it is, as solely the result of continuous and strenuous labours on the part of Militia Artillery Officers who—not only now give splendid service, but in the days before the war—gave of their best in preparation for the troubled times all felt would sooner or later fall upon us.

I venture to say that no Divisional Artillery in the British Army today can point to such an extraordinary constructional record.

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MEASURING THE VELOCITY OF PROJECTILES.

EXTRACT FROM " ENGINEERING,"

11th June, 1920.

The new chronograph for proving-ground practice, which Paul E. Klopsteg, of the Leeds-Northrup Company, and Alfred L. Lovmis, late Major in the United States Ordnance Department, described before the Convention of the American Institute of Electrical Engineers in February last, is not of the Boulengé type. In these latter instruments the projectile opens an electric circuit by breaking the wires of a screen. In the new "Aberdeen chronograph"—so named after the proving ground at Aberdeen, Maryland, on which it was first used—the projectile closes the recording circuit by piercing two lead plates, previously insulated from each other, and it is claimed that the make-circuit arrangement renders the instrument more simple and more reliable than the Boulengé, and that the manufacture of a complete chronograph does not take more than one working day of 24 hours. The lead screen or contact target consists of two lead plates, 3 in. by 12 in., for the 3-in. gun, attached to the two faces of a larger sheet of paraffined paper; the projectile hits and pierces the front plate normally and closes the circuit as soon as it touches the back plate. The circuit, comprising a condenser and the primary of a transformer, leads to a spark point, mounted within a shallow aluminium drum which is rotated about its axis by a constant-speed motor. The speed control of this motor, which runs at 25 revolutions per second, is one of the essential features of the chonograph. A strip of paper, 500 mm. long, just fits into the drum, resting against the inner circumference; the paper is blue and thinly paraffined so that the spark passing between the terminal mentioned and the metal of the drum leaves a blue mark. Vertically above this sparking terminal are two more, joined to the circuits of a second and, if necessary, of a third lead. The contact targets are placed at distances apart of 50 ft., 150 ft. or 200 ft. (100 ft. for the first screen near the muzzle being customary for other chronographs). It is claimed that even with the two targets only 25 ft. apart, the Aberdeen chonograph gives records correct within 1 ft. or 2 ft. on velocities of 1,700 ft. per second. The records are checked by the aid of a fall apparatus which can readily be connected to the same sparking terminals. In this apparatus a steel ball rests on a lever which is knocked away when a weight is released; the release closes one circuit, the ball striking the base of the apparatus another. The height of fall and motor speed are so adjusted that normally the two spark marks should be exactly in the same vertical on the paper strip, the motor describing five revolutions during the period of the fall, 0·2 second; when the two marks are not in the same vertical, the motor speed is too great or too small. In general the check test need not be performed more than twice a day. The motor is started before firing; the velocity is

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directly determined by holding the strip (taken out) against a scale. The whole determination requires half a minute. The contact target has then to be taken down and to be refixed. An advantage of the reduced distance between the two targets is that the targets need not be fixed at inconvenient heights when the guns are elevated. The whole Aberdeen chronograph fits into a portable box; it was put into regular use in June, 1918.

CONTENTS OF LEADING FOREIGN JOURNALS.

America.

The Journal of the U.S. Artillery—September, 1920.

The R.O.T.C. Number is interesting as it shows how America proposes dealing with the question of educating officers for the next war. A quotation from an article by Maj. Allen R. Edwards, C.A.C., Professor of Military Science and Tactics, Columbia University may be of interest.

"In the Army Bill which has recently been enacted into Law, Congress has given the country the best military legislation in its history.

It has provided for a standing Army large enough to repel any sudden invasion or to furnish the nucleus for an expeditionary Force. . . . . In any prolonged struggle however . . . we must still depend upon our Citizen Armies. That these may be rapidly mobilized, thoroughly trained, cared for in camp, and properly led on the field of battle is a grave responsibility which Congress has met and provided for by the establishment of the Reserve Officers Training Corps.

From where are we to draw the material for this vital element of our new military policy? We will let the Secretary of War, Mr. Baker answer this question in the words that he used in his address to the students at Lehigh University—Mr. Baker said:

"It is to the collegiate institutions of the nation that we must "always look to supply the material from which commissioned officer "personnel for our immense citizen armies must be developed. . . . ."

France.

Revue d'Artillerie—August, 1920.

I. Meteorological Calculations in the preparation of Artillery Fire in the French and German Armies (i) Extract from a lecture by E. Rothé.

II. Liaison between Artillery and Infantry—Impressions of a Field Artillery Officer. (Concluded).

III. Range tables during the war. (Concluded). J. Boissonet.

IV. German and Austrian High Power Guns. (Continued).

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V. Miscellaneous News.

Germany. The Status of Artillery in the Army.

September, 1920.

I. Reflection on Internal Ballistics. Gén. Gossot and E. Liouville (with reference to articles in April—May—June numbers by Capt. Desmazières.)
II. Meteorological Calculations (continued). E. Rothé.
III. Notes on Registration by High Bursts.
IV. German and Austrian High Power Guns. (Continued).
V. German Minenwerfer. (Translation).

Revue Militaire Générale— September, 1920.

The future of Permanent Fortifications. Gén. X.
The Military Forces of France. (Continued.) Gén. Thevenet.
The first strategic check to the Germans (21—25 August, 1914). (Maps.) Capt. Koeltz.

Jean Bigorre in reviewing "L'Armée allemande depuis la défaite" —Paul Gentizon—(Payot) says:

> "Never was a study more opportune, or better done than this . . . by the well informed author of "The German Revolution" . . . . it ought to be read and thought about in France, and also, perhaps above all abroad, where the terror of French "Militarism" and "Chauvinism" seems at times to obscure the clear vision of realities."

Belgium.

Bulletin Belge de Sciences Militaires— October 1920.

I. The German Cavalry on the Belgian Front, 3—20 Aug., 1914. Lt.-Col. A. E. M. Schmit.
II. The War on Parasites (2). Drs. de Coster and Sillevaerts.
III. Notes on Armoured cars. (Continued.) Capt. Comdt. Vander Donckt.
IV. On the rôle of the Officer seen from the War. Capt. Comdt. Menzel.
V. Graphic charts for the solution of fire problems (1). Capt. Taymans.
VI. History of Tanks (1).

The French and English experiments, neither country knowing what the other was doing before 1916.

25 June 1916, Gen. Estienne sent to England, after which English Tank Corps and French Assault Artillery worked in close collaboration. Early history of manufacture—Employment during the war. Authorities quoted.

Les Chars d'Assaut. Capt. Dutil.
Sous l'Armure. Pierre Lestringuez.
Tanks in the Great War. Col. Fuller.

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VII. The Military Situation in Germany. With map showing the military division of German Territory.

(1) The Boulogne Conference June 1920.

(2) Situation at commencement of Spa Conference July 1920.

A. Composition of Army—Reichswehr—Regulars—Protective Police—Citizen Guards—Volunteers—Marine units, Irregular Troops, Worker's detachments.

B. War Material.

(3) The Spa Convention.

(4) Steps taken by Government after the Spa Convention.

A. Disarmament of civil population.

B. Conversion of army of 200,000 to one of 100,000. The Fleet.

C. Protective Police.

D. Citizen Guards and Volunteers.

The "Orgesch" (Organisation Eischerich).

(Cp. Revue Militaire Générale—Changes in German Army. Feb.—Mar. 1920.)

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SOME EPISODES DURING BATTLE-FIGHTING ON THE WESTERN FRONT.

Continued from the October number of "The Journal."

Communicated by

MAJOR-GENL. SIR H. C. C. UNIACKE, K.C.M.G., C.B.

XXXIX. Liaison between Field Artillery and Infantry.

The following incident which occurred during the fighting in the Sensée Valley on the 27th August 1918 is of interest as illustrating close support given to infantry in attack, and the well directed fire from Field Artillery in close liaison with Infantry.

On August 27th the Guards Division attacked at dawn and the fighting was severe. The Germans held stubbornly to several strong points, Haly's Copse, Mory Copse, etc., with heavy machine gun and rifle fire. The 72nd (Army) Brigade, R.F.A., commanded by Lieut.-Colonel F. W. Richey, D.S.O., R.G.A. was covering the Irish Guards in their attack. The Brigade F.O.O. was wounded early, and the officer starting out to take his place was wounded immediately after leaving his battery; touch was therefore momentarily lost. Lieut. Fowler, orderly officer to the Brigade Commander, went forward to try and get some news as to the situation of the Irish Guards. He found them in a trench just east of St. Leger, their advance having been checked by very heavy fire from Banks Trench, about 100 yards in front of them.

Banks Trench was just over the crest which covered the batteries of the Brigade from view; A/72 could just hit it at 1500 yards, the range from 'B' and 'C' Batteries was too short for their shells to clear the crest. Lieut. Fowler picked up the two signallers of the F.O.O's party and started registering "A" Battery on Banks Trench, one signaller was severely wounded and rendered quite incapable of further duty, the other signaller was also wounded but managed to carry on. With his help Lieut. Fowler completed an accurate registration of the trench.

At 7 p.m. by previous arrangement with the infantry "A" Battery fired a 5 minutes *strafe*, the last minute being at "Gun-fire"; the howitzers of D/72 joining in with 200 yards more range and acting as a 'stop' to prevent the enemy bolting back. The shooting was wonderfully accurate and the moment the batteries stopped firing, all the Germans in the trench walked over with their hands up. One hundred and fifty Germans surrendered there, and the Irish Guards took their place in Banks Trench unmolested.

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GIFTS AND PURCHASES DURING THE MONTH OF SEPTEMBER, 1920.

Books Presented.

By The Secretary, War Office.

Handbook of the B.L. 9·2-inch Howitzers, Marks I & II. 1920.

Priced Vocabulary of Stores used in His Majesty's Service. Part I. 1920.

Price List of Emergency Pattern Stores used in His Majesty's Service. War Office, 1920.

Priced Vocabulary of Clothing and Necessaries. War Office, 1920.

Addendum to the Handbook of the 14-inch (45 Cal.) B.L. Gun, Mark III, on Railway Truck Mounting. Appendix IV. Particulars of the B.L. 18-in. Howitzer on Railway Truck Mounting. 1920.

The Army Act, 1920.

By The Authors.

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A Glass Hand Grenade dug up in the ditch of Nicosia Castle, Cyprus.

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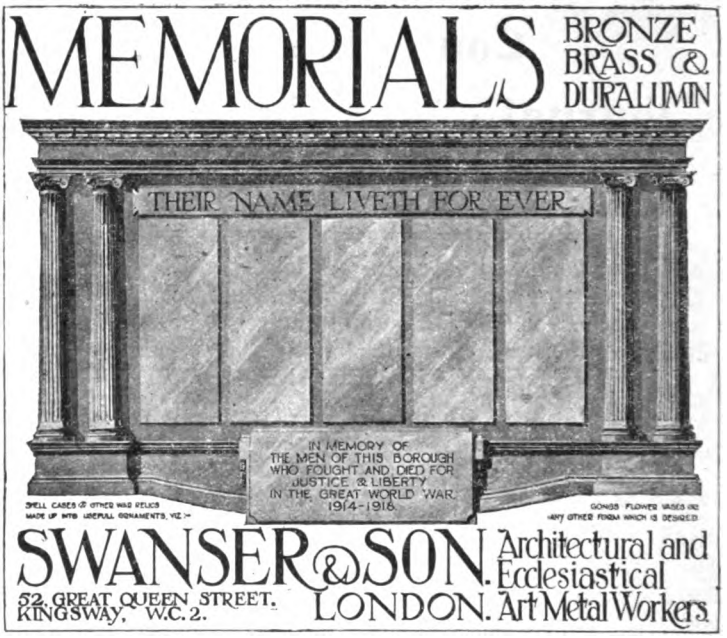

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"DUNCAN" COMMENDED ESSAY.

1919-20.

"The Reorganisation of the Royal Regiment of Artillery with a view to obtaining in war the best value from modern equipments with a minimum of expenditure of human energy."

By Major & Bt. Lt.-Col. H. M. Vandeleur, c.b.e., R.G.A.

MOTTO: "ARMA VIRUMQUE CANO."

The Duties of the Royal Artillery.

BEFORE coming to any definite conclusions as to the re-organization of the Royal Regiment, it is necessary to consider the nature of the work with which it may, in the future, be entrusted.

The last few years have not only brought about a great development of mobile and semi-mobile equipments, but have also resulted in the necessity of our Forces being provided with guns carried in aircraft, with anti-aircraft guns, and with trench mortars.

It can be taken for granted that all guns carried in aircraft will be manned by the Royal Air Force. There may, however, be some doubt as to by whom anti-aircraft guns should be manned. It is argued by many that the Service responsible for our own aircraft should control all the means adopted for attack of and defence against enemy aircraft. There is a great deal to be said in favour of this argument. We may, however, safely assume that, for the next few years at any rate, anti-aircraft guns, other than those afloat, will be manned by the Royal Artillery, who must necessarily work in close co-operation with the Royal Air Force.

Trench mortars will, presumably, be allocated entirely to the Infantry.

The armament of defended ports and coaling stations affords a problem somewhat analogous to that of anti-aircraft artillery. This armament, designed primarily for the attack of such hostile warships as may come within its range, forms, with its searchlights and other accessories, only a part of the means of defence available, the remainder being entirely in the hands of the Royal Navy. Such a division has little to commend it, and it is easy to imagine that it might in some circumstances prove to be highly dangerous. Surely when guns are firing over a sea area in which our own ships and submarines may be operating it would be wise for the Royal Navy to have complete control. That this policy is to be adopted has lately been rumoured but, until it becomes a *fait accompli*, our regimental organization must provide for the manning of what is somewhat inaccurately called "Coast Defence" armament.

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We see then that the organization of the Royal Artillery must ensure the efficient service of coast defence and anti-aircraft armament as well as that of all artillery equipments provided for use in land operations. These latter equipments may be classified, according to the methods adopted for their transport, as follows:—

(a) Horse drawn guns and howitzers.
(b) Pack artillery.
(c) Mechanically drawn guns and howitzers capable of travelling by road. In this class are included guns mounted in tanks, or carried on lorries.
(d) Guns and howitzers travelling on, and firing from, railway lines.

Coast defence armament may include equipments of one or more of the above classes, in addition to fixed mountings, while anti-aircraft equipments will normally be either fixed or mechanically transportable.

The General Principles to Follow in the Re-organization.

Artillery officers seem to be in general agreement as to the desirability of considerable changes in our existing organization, with a view to ensuring a maximum of efficiency combined with a minimum expenditure of human energy. They are perhaps not in entire agreement as to which of two broad roads to follow in order to achieve the best results. One arm of the signpost points to "specialization," the other to "unification." The latter is surely the better road to take. A closer study of the signpost shows that the first road goes via "extravagance," the second via "economy." Let us then follow the road to "unification," with an eye on any by-path which may help us on our way.

The Effect of Modern Developments in Equipments.

The tendency of modern equipments seems to some of us to become, year by year, more complicated from the mechanical point of view. Hence, it may be argued, arises the need for greater specialization. Hence the necessity for an artillery officer to spend as much of his service as he can with the same type of equipment in order that he may at least be an expert in one line, even though it be a very narrow line.

Consideration shows these arguments to be fallacious, and the growth of mechanical knowledge will soon dispel them. The proper application of mechanical devices tends, not to complicate our equipments, but to simplify them. We live in a mechanical age. The young officer who has not a fairly good working knowledge of the mechanism of a motor-car is becoming more and more difficult to find. There need be no fear that modern developments are going to cause great difficulties as far as equipments are concerned. Training must be adapted to suit conditions as they change.

The Faults in the Existing Organization.

The test of war has shown that the existing organization, with its sharp line of cleavage between Horse and Field Artillery on the

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one side, and Garrison Artillery on the other, is insufficiently adaptable to sudden changes in the demands made upon the Regiment. The brilliant success of the Royal Artillery in the late war resulted in spite of, rather than on account of, our organization, which was framed for the days when, speaking generally, guns were either taken into position by horses or were not taken into the field at all.

Lessons of War.

From the wars of our generation one lesson stands out clearly. It is that, no matter how we classify our various natures of artillery—Horse, Field and Garrison—Field, Heavy, Mountain and Siege—call them what we will, we can never predict the relative proportion of each which it will be found necessary to employ. It follows that if we study economy, and study it we must, we should aim at as much interchangeability between the different branches as possible.

The conditions of the South African War were such that Garrison Artillery, trained till then with fixed armament, were sent on active service with mobile guns. In the late war this was repeated on, of course, a far greater scale. Much human energy would have been saved had these men, in peace time, been trained as all-round artillerymen, and been given some experience of work in the field.

In France, a Horse Artillery Battery, armed with Field Artillery guns and commanded by a Garrison Artillery officer, may not have been a usual combination, but it certainly existed at one time. That this Battery was, under these conditions, efficient in action is proof of the wonderful adaptability of the Gunner. This particular case is only mentioned here as typical of hundreds of others which might be quoted in support of the contention that we should be prepared for interchangeability between branches of the Regiment, and that our peace training should be such as to facilitate such interchange.

It follows that our organization must be as elastic as it is possible to make it without loss of efficiency. There must be no hard and fast lines drawn between the different branches of the Regiment. Units must be ready, when the occasion arrives, to make themselves efficient with equipments of a totally different nature to those to which they are accustomed.

As will be seen later, it is proposed in the case of anti-aircraft units to modify this general principle of interchangeability.

The recent Army Estimates promise us a peace establishment of Artillery so small that it becomes a matter of the most vital importance to obtain such an organization as will ensure that we may be able on or after the outbreak of war usefully to employ every existing artilleryman in the position where he is most urgently required. Officers, who devote the best part of their working life to the Service, must be, first and foremost, artillerymen. They must drop all classifying labels. They must not be allowed to think that their whole service is to be spent with guns on fixed mountings at pleasant (or perhaps most unpleasant) seaside stations, nor must they be allowed to consider themselves as belonging permanently to a mounted branch. These luxuries cannot be afforded in "a contemptible little army." No, the artillery officer must be true to his regimental motto, and he must above all things be a master of guns

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and gunnery. Gunnery is every day becoming a more and more exact science. All guns from Big Bertha down to the lightest Q.F. weapon have much in common, and up to a certain point all gunners should be taught in the same school.

How Organization Affects Training.

The pre-war training of the Army for land warfare was mainly Divisional. A very large proportion of our Artillery lay outside the Divisional organization; their education in the field was in consequence somewhat neglected. One natural result was that Commanders of Divisional Artillery, and of lower organizations within the Divisions, had no experience of artillery other than Horse and Field Batteries and a meagre number of 60-pr. horsed batteries. The possibilities of heavy guns and howitzers were insufficiently studied and insufficiently understood. That the organization of the Regiment drew a sharp line practically between mobile units on the one side and what may be called semi-mobile and immobile units on the other was certainly a contributary cause of this lack of understanding. It is obvious that above a certain point in the organization of a field army the command of all artillery in a given area must be vested in one man. That man will be the better able to secure economical efficiency in his command, and to do the greatest possible damage to the enemy, if his training and experience have been such that he is familiar with the various types of weapon at his disposal. It may not be practicable to ensure that, before an officer reaches the rank of Lieutenant-Colonel in normal times, he shall have spent a useful period of his service with units of each of the four classes (a, b, c, and d) of artillery given above, but he should certainly have served with more than one.

It is too early to predict the elimination of horse traction for artillery. It needs no great prophetic power to realise that guns in tanks, and heavy guns, mechanically drawn, will play a great part in the years before us. Future artillery commanders should therefore have as wide a knowledge as possible of the capabilities and of the best methods of employment of all these different types, and organization should aim at facilitating the acquisition of this knowledge. Individuals may and do acquire the knowledge without actually having served with units of more than one type, but they are rather the exception than the rule. Every artillery officer should, as far as his inherent capabilities permit, be trained as an all-round artilleryman and this result can best be arrived at by having one homogeneous Regiment of Artillery without any hard and fast subdivisions.

It may be contended that, if the above argument be carried to its logical conclusion, the writer must advocate that every officer in the Army should be thoroughly trained by service in every branch of the Army. Such a course is manifestly impossible, and a Commander of a force of all arms must necessarily trust to his Staff as regards many large questions. His own knowledge of arms other than that in which he has been brought up will have been acquired by study and observation, possibly (and desirably) supplemented by

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short periods of attachment. In the same way the Artillery Commander should gain a thorough understanding of Cavalry and Infantry. He should be, and with good organization he is quite capable of being, familiar with the working of every type of battery under his command.

The Limitations of the Personnel.

The main difficulty in organizing the Royal Artillery does not arise so much from the variety of guns handled by them as from the different methods adopted for the transport of these guns. You cannot take a man whose instincts have led him to have nothing whatever to do with horses and expect him to be of value in command of a horsed battery. He will never have fit horses. He may be a first rate artilleryman, a good leader of men and a courageous fighter, but all these qualities are of little avail if his lack of horsemastership immobilises a mobile battery.

Similarly there are probably men quite capable of clearly understanding the mechanisms and mountings of their guns, and yet unable to diagnose the most simple and common type of trouble in a petrol engine. Such men would not be suitable for mechanically-drawn batteries, since they would not be competent to supervise the care and maintenance of their means of transport.

It is evident therefore that there will always be a proportion of officers who are unfitted for posting indiscriminately to every branch of the Regiment. They may possess all the qualifications required for a good artillery officer, except that they fail as regards their knowledge of one particular method of traction.

The existence of these officers complicates the problem of organization. We must not impair the efficiency of the Regiment by transferring them from a branch in which they are of value to one for which they are unsuited. On the other hand, they must not be allowed to remain permanently in one branch if by so doing they are interfering with the training and experience of others. It will, it is thought, be found easy advantageously to retain officers of the types referred to, though, on account of their limitations, they may not be able to qualify for promotion to the highest ranks.

Tradition.

Any scheme of re-organization will be faulty if it is not designed to preserve and foster the glorious traditions of the Regiment; traditions inherited from our forefathers, revivified and kept untarnished during the late war. In this direction we can expect but little help from a War Office too fully occupied with questions of the most material import to allow itself to be distracted for a moment by matters of sentiment. And yet who will deny the relationship between tradition and efficiency? Who will dispute the value of that *esprit de corps* which has always been our proud possession?. Let the reader turn to the pages of the historians of the Regiment, Duncan Hime, Jocelyn and Leslie. He will find countless instances where success has been proved to have been the fruit of that *esprit de corps,*

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of that justifiable pride in the Royal Regiment, with which every true Gunner is imbued.

In the introductory chapter of Duncan's History of the Royal Artillery appear the following words:—

"The Battery is the unit of Artillery; all other organization is accidental. Whether the administrative web, which encloses a number of Batteries, be called a Battalion or a Brigade system, is a matter of secondary importance. It is by Batteries that Artillerymen make War; and it is by Batteries that their history should be traced."

Since those words were written much water has flowed under the bridges; artillery has been employed on a scale undreamt of by the historian from whose work the quotation is taken; mechanical science has made enormous strides; methods of communication, and consequently the means available for the control of Artillery in action, have been revolutionized. Still the basic principle remains unchanged. Artillery must be organised in small self-contained units. It matters not whether the equipment of these units be horse-drawn or mechanically drawn, or carried in tanks or on lorries, or built solidly into some rocky coast fortress. Let the units all be called Batteries. Let them bear the honours and carry on the traditions of those Batteries from which they have been evolved, and of those reduced Batteries which they have absorbed.

There exists to-day (or did until recently) one defect in our organization which must not be perpetuated. Probably to suit the convenience of some subordinate official who found the clerical work connected with the provision of drafts for foreign stations to be irksome, it was suddenly decreed that all Garrison Artillery Companies should remain for ever at the stations where they happened at the moment to be, but that the officers and men should only remain at that station for a fixed period of time. It was argued that as a necessary result of our conditions of foreign service and of our short service system, both officers and men were, under any scheme of organization, frequently transferred from one unit to another, and, therefore, that no objection could be urged against the innovation. It was further argued that economy would result. Possibly there was some insignificant monetary economy, though that seems doubtful. Possibly the work of a few clerks was simplified. Actually, the immediate result was a loss of efficiency in our Coast Defence Stations. Mathematically the scheme may have been sound. On paper it may have been quite in accordance with "business methods." In fact, it was unsound and uneconomical. It was designed without any consideration of that most important factor, the psychology of the Gunner. To him, to be posted to, to belong to, a particular unit means a great deal, and the fact that that unit, stationed perhaps at Hong Kong, can claim some sort of relationship with a battery that distinguished itself in the Peninsular War means more. He may know perfectly well that he cannot expect to remain long with that unit, but that fact does not trouble him; he *belongs* to it, he holds his head high and the honour of the Company is his honour. Tell the same man that he is to remain with that Company for three

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years, no more and no less, and you rob him of a great incentive to do good work.

In re-organizing, let us remember the Chestnut Troop, "L" Battery, the Battle-axe Company, and all traditions worthy of honour and remembrance.

Anti-Aircraft Batteries.

For anti-aircraft work very special training is necessary. The peace establishment of regular officers allocated to A.A. Batteries will presumably be small. Would it be sound to bring these officers into the general scheme of interchangeability between branches? We think not. Anti-aircraft gunnery is in its infancy. It is an especially difficult branch of artillery science and needs much development. For the present, the best way of achieving and maintaining the greatest possible efficiency, of developing suitable equipment, and of perfecting our knowledge of high angle firing, will be to post officers permanently to anti-aircraft artillery, in order that they may specialize. They will, of course, interchange between the different forms of A.A. batteries, and will serve in turn with fixed and mobile equipments. Their chances of active service will not be less than those of their brothers in other branches, and there is no reason to suppose that service in the Anti-Aircraft Artillery would be unpopular amongst officers. They should remain in their places on the general list of Artillery officers for promotion and seniority. Transfers from and to the anti-aircraft branch should be permissible but exceptional.

Coast Defence Artillery.

The regular artillery personnel of coast fortresses should consist, as at present, of the required number of units commanded by Majors. For reasons already given it is desirable that these units should be designated as Batteries. They should cease to be "localised," but should periodically move from station to station.

The majority of these batteries will be allocated to fixed defences, whilst some will be equipped with movable armament. As regards their training and equipment, these latter batteries should approximate as nearly as possible to those of the field army. The personnel of the fixed armament should receive some training in the field.

Until the Royal Navy relieve us of the responsibility of coast defence fixed armament, the officers required must be found from the general Regimental list. This should in no way impair the general efficiency of the Regiment. Coast defence gunnery is now a very exact science and presents no particular difficulty to any well-trained artilleryman. With whatever type of equipment he may have learnt his trade, he should in a very short space of time be able to adapt his knowledge to the requirements of a Coast Fortress, and whilst doing so he will learn much that he will find useful when he returns to a mobile battery.

The only alternative would be to treat coast artillery as a distinct branch, as is proposed for anti-aircraft artillery. A great objec-

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tion to this is the difficulty which would be found in obtaining good officers for work which offers little prospect of active service and small hopes of advancement. There is the further objection that, as we have already seen, a time may come when the personnel are wanted in the field.

Transport.

We have seen how the question of transport complicates that of organization, but let us be emphatic on one point. A battery must be capable of manœuvring its guns without assistance from any other unit or organization. During the war those batteries which were not horsed relied on the R.A.S.C. for their transport. Those very batteries are loud in their praises of the great efficiency of the R.A.S.C., of their harmonious co-operation, and of their readiness to go far beyond the "letter of the law" in the help they gave. The system was, however, a compromise, forced on us by the exigencies of war, and compromises are rarely economical. Turn again to the pages of history, and study the causes of the failure of the system under which Field Batteries were horsed by the R.A. Drivers. That system was universally condemned. All the objections to it, save one, have been verified in the late war. That one is certainly important, it is that the R.A. Drivers were undisciplined and inefficient. Had that been the only cause of failure the appropriate remedy would have been soon applied. Discipline and efficiency in the Drivers Corps would not however have converted an obviously bad organization into a good one. The Field Batteries would never have achieved a really high standard of efficiency until they were self-contained and complete in themselves. So it is to-day with our mechanically-drawn batteries. Every battery must possess its own means of transport and must be allowed to keep it intact.

It must also be remembered that every step in the development of artillery means longer ranges. Every improvement in the manufacture of steel means that, weight for weight, the newer gun will have the greater strength. Every improvemnt in the manufacture of propellants means that for a given maximum pressure in a gun, a greater range can be obtained with a projectile of given weight and form. Every advance in the science of the mechanics of traction means that heavier pieces can be taken into the field. Let us look ahead, and be prepared for enormous increases in range.

One other thing must be remembered, and that is that great developments in artillery take place after a war has begun, and the struggle to outdo the enemy has become a matter in which all the best brains of the nation are interested. We must always organize on the assumption that our equipment will improve in every direction. Ranges will be longer and observation will, consequently, be more difficult. Battery organization must, therefore, be such as to allow for the efficient working of far-distant observation posts; the requisite means of transport must be provided.

Higher Organizations than the Battery.

Batteries should be grouped as now, both in peace and war, about three batteries forming a Lieutenant-Colonel's Command.

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For convenience, this command will here be referred to as a Brigade, a designation which will probably soon be altered.

In war, a brigade should be composed of similarly equipped units.

In peace, we must to some extent look on our regular army as the nucleus of a much larger army; we must foreshadow the probabilities of casualties in war time; in short we must anticipate rapid promotion, and arrange our training accordingly. From this point of view, there is an advantage in having "mixed" Brigades in peace time, that is in putting batteries equipped with both horse and mechanical traction under one Lieutenant-Colonel.

Assuming that our permanent striking force, or expeditionary force, is to consist of six divisions, peace training will be largely carried out under Divisional Commanders. A large part of the heavier natures of artillery may in war time, when the force consists of two or more Divisions, be under a Corps or Army Commander. For educational purposes, the best plan in peace time will be to allot all Corps or Army Artillery to Divisions, except when manœuvres or training can be carried out on a grand scale.

Artillery Schools.

Three permanent schools are required, *viz.* for mobile artillery, for anti-aircraft artillery and for coast defence artillery. By mobile artillery is meant here all artillery (other than anti-aircraft) capable of taking part in land operations.

Any one school may, of course, be spread over as many stations as may be desirable, and the aim should be to obtain as much variation as possible in the nature of the *terrain* available for practice and training purposes.

The three schools should be under one head, who should keep them in close touch with each other. In this way, any advance in artillery knowledge can be made the common property of the Regiment, and all branches will benefit thereby.

In the same way that the three schools must keep in touch with each other, they as a whole must keep in touch with the corresponding schools of the Royal Navy and the Royal Air Force.

In addition to these schools, the Regiment requires a thoroughly well-equipped and well-staffed scientific college. The Ordnance College supplies this want, but the application of science to artillery is every day growing wider, and it is important that the College should be kept abreast of the times. Names are perhaps unimportant, but we should like the word "Artillery" to be substituted for "Ordnance" in the title of this establishment.

Development of Matériel.

It is essential that the Regiment should keep a close eye on the development of their equipments, and be in a position to guide designers along the right path. This is probably best assured by the existing arrangement of seconding suitable officers to deal directly with research, design and manufacture.

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A Suggestion.

It is our proudest boast that His Majesty The King honours us by being our Colonel-in-Chief. Our pride is very real when we think of the records of our Colonels Commandant. Between them and the Regiment should there not be an executive Chief? It is suggested that a new office should be created, to be held by some distinguished General Officer on the active list. He would constitute a connecting link between our Colonel-in-Chief and his Regiment. Certain executive duties, connected with the *personnel* of the Regiment would be allotted to him. The office would be no sinecure and would benefit the Regiment in many ways.

It seems doubtful whether any objection can be advanced against this suggestion, other than on the score of expense. The writer has insufficient knowledge of the internal organization of the War Office to enable him to say whether the proposal, which would result in the transfer from that office of a certain amount of work, would require an appreciable addition to Army Estimates.

Conclusions.

No drastic changes, no revolutionary upheavals are proposed. On the contrary, we must keep intact the main fabric of which we are so proud, and only make such slight alterations as are indicated by the progress of Artillery science.

The first step in our proposed re-organization is the amalgamation into one of the two separate lists of Officers of the Royal Regiment. It is difficult to see how this can be done without hardship to individuals, but it should be done quickly and absolutely. If every care is taken to minimise unavoidable injustices, the Regiment will not complain. Each branch is ready to sacrifice something for the common good. The weak course to take would be to adopt a slow and lingering method of amalgamation with the attending consequences of years of suppressed jealousy and discontent. Let us hope that the stronger course will be followed.

The next proposal is that the Regiment should be organized by Batteries designated Royal Horse Artillery and Royal Artillery. For convenience the full titles of Batteries might be as follows:—

1. HORSED AND PACK BATTERIES.

A.B., etc., Battery Royal Horse Artillery.

1st, 2nd, etc.,	Light Field Battery.	Royal Artillery.
„	Light Howitzer Battery.	
„	Heavy Field Battery.	
„	Heavy Howitzer Battery.	
A.B. etc.	Mountain Battery.	

2. OTHER BATTERIES.

1st, 2nd, etc.,	Tank Battery.	Royal Artillery.
„	Siege Battery.	
„	Fortress Battery.	
„	A.A. Battery.	

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The above titles, to some extent perhaps prophetic, indicate sufficiently the equipment and the rôle in war of the units to which it is proposed that they should be applied.

In peace time, all artillery destined for employment in the field, should as far as possible be included in, or attached to, the organization of a Division.

Officers should, during their service, be given as wide a training as possible by association with batteries of various types, with the exception that officers posted to units of the anti-aircraft branch should remain with units of that branch.

Training must aim at fitting officers for any branch of the Regiment.

The transport required by units for purposes of manœuvre should belong entirely to the artillery organization.

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LINES OF COMMUNICATION IN FRANCE.

A BRIEF SUMMARY.

By Col. F. D. Logan, c.m.g., d.s.o., R.A.

MUCH has been written of the work in the Forward Zones of the War Area, but little seems to be generally known of the organization and work on the Lines of Communication in France. The following brief description may therefore be of interest to those who did not serve at any time in the Lines of Communication Area and who had no experience of the difficulties of the Lines of Communication and of the work done in preparing for and carrying out the scheme of Demobilization.

In the Field Service Regulations the "Lines of Communication" are defined as "The Systems of Communication by rail, road, and navigable waterways between the army and its Base, or Bases, of operations inclusive, together with the district through which they pass within such limits as the Commander-in-Chief may determine." From this definition it will be readily realized that the Lines of Communication in France, with the numerous Base ports, comprised an extensive area which in the first half of the war was gradually expanding. Its sub-areas grew in size and number until by 1916 the Lines of Communication area was divided up into 12 Bases and Areas, viz:

> Dunkirk, Calais, Boulogne, Dieppe, Rouen, Havre, Brest and Marseilles Bases, and Etaples, Abbeville, St. Omer and Abancourt Areas.

In the Summer of 1917 "Trouville Hospital Centre" was added, and the Mediterranean Line of Communication through France, which had been functioning under the War Office direct, was taken over by the B.E.F. France. This latter step involved the Lines of Communication Area taking over Cherbourg and the maintenance of the rest camps and of the haltes-repas on the railway line from Cherbourg to Italy, via Paris, Modane and the Riviera. A Paris area was then formed (subsequently renamed Central Area) which administered one or two installations in Paris (i.e. Mechanical Transport Workshops and Ordnance Repair Shops, etc.) and also the Canadian Forestry Companies which were established all over France in the forests of the north-west and south-west departments, the Vosges, Jura and Bordeaux country. This area also included the Ports of Bordeaux and Bayonne which were utilized for the export of timber, and the big rest camps at St. Germain au Mont D'Or near Lyons.

From time to time as the ebb and flow of the Armies occurred, areas were added, or increased in size or reduced. On one occasion the boundary between the Lines of Communication area and the Armies was, roughly, the line Ypres—Peronne. In the main, however, there were 14 Bases and Areas, viz:—

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Dunkirk, Calais, Boulogne, Etaples Area, Abancourt Area, Abbeville Area, Dieppe, Rouen, Havre, Trouville Hospital Centre, Cherbourg, Brest, Marseilles and Paris (or Central) Area.

Amiens and Arras Areas were incorporated in the Lines of Communication for a short time just before the Armistice but were soon taken over again by the armies.

In 1918 the numbers on the Lines of Communication reached a maximum of 609,000 and the minimum was 530,000.

The various Bases or Areas differed in number and size according to their importance as Ports and the nature of the various installations established within their respective jurisdictions. Briefly their average numbers, etc. were as follows. (Commandants are given for period about Armistice).

DUNKIRK.—10,000. Commandant— Col. G. C. Marescaux, (Rear-Admiral ret. R.N.) Succeeded by Brig.-Gen. R. McDouall.	Chiefly Docks and Inland Water Transport. An important Naval Port. After the Armistice increased to over 20,000. Demobilization Camps, and Train Ferry terminus.
CALAIS.—100,000 Commandant— Brig.-Gen. F. W. Radcliffe.	Ammunition dumps. Zeneghem, Bourbourg and Audruicq. Ordnance Supply, Railway, R.E. Installations, Base Depôts, Prisons, Hospitals, Remounts, Veterinary Hospitals, M.T. Depôts, Docks, I.W.T., Leave Camps and Train Ferry terminus.
BOULOGNE—80,000. Commandant— Brig.-Gen. H. W. Wilberforce.	All chief Directorate Installations, Labour Corps Base Depôt, Leave Camps, Hospitals, Convalescent Depôts, Prison and later Demobilization Camps.
ETAPLES.—70,000. Commandant— Brig.-Gen. Lord Ardee.	Base Depôts, Hospitals, Convalescent Depôts. Dannes Ammunition Dump.
ABBEVILLE—30,000. Commandant— Col. F. C. Hulton.	Various Installations, Advanced Horse Transport Depôt, Convalescent Depôts. Saigneville Ammunition Dump. Prisoners of War collecting Centre.
DIEPPE—25,000. Commandant— Col. A. S. Q. Ricardo.	Remounts, Veterinary Hospital, Hospital, Convalescent Depôt. Rouxmesnil Ammunition Dump. Demobilization Camps. Train Ferry Terminus.

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ABANCOURT—20,000 Commandant— Col. W. B. Pearson.	R.E. Stores, Ordnance. Blargies Ammunition Dump, Veterinary Hospitals, etc.
HAVRE—65,000. Commandant— Brig.-Gen. J. Nicholson.	Base Depôts and all Installations. A big Shipping Port. Demobilization Camps.
ROUEN—100,000. Commandant— Brig.-Gen. L. A. Philips.	D.A.G. 3rd Echelon, all Installations, Base Depôts, etc.
TROUVILLE Hospital Centre—20,000. Commandant— Maj.-Gen. S. Hickson.	Convalescent Depôts and Hospitals
CHERBOURG—6,000. Commandant— Col. H. L. N. Beynon.	Rest Camps. 2 Base Depôts, not much used. Port for troops proceeding to and from Italy and the East. Train Ferry Terminus.
BREST—500. Commandant— Col. Harrison.	Naval Port, not much used except for Portuguese. (Americans of course used this Port very much).
MARSEILLES—10,000. Commandant— Brig.-Gen. R. C. B. Lawrence	Various Installations, Hospitals, etc. and Port for the East.
CENTRAL AREA—22,000. Commandant— Brig.-Gen. B. G. Price, who succeeded Lt.-Gen. Sir D. Henderson.	Ordnance and M.T. Installation in Paris. Rest Camp near Lyons. Forestry Companies scattered over France.

The above figures give an idea of the task with which Commandants of Bases had to deal. The numbers were in some cases larger than a Corps and there were no lower formations under which units etc. could be grouped and administered. Moreover each of the larger Bases extended over an area of several hundred square miles. The great majority of the permanent personnel were men who had been specially enlisted as skilled tradesmen for work under the various Directorates and who had had little real military training. In many cases their officers were men who had excellent business and technical qualifications but had little experience in the art of looking after their men out of working hours. As explained below these men were only partially under the Base Commandant, i.e. for Defence, Accommodation, Discipline, Sanitation, and Training. For allotment of work, the work itself, and demobilization and leave allotments they were under their several Directorates, so that one would find for instance in a Docks Area within a Base various types of labour working, viz.: The inboard labour working on the cargo on a ship under the Navy, Cranesmen transferring the cargo to the shore under the Docks Directorate, Labour Cos. working on the Quay under the

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Labour Directorate, Personnel of Ordnance, Supply, Transportation, etc. Directorates supervising the discharge of their own stores, Bargemen under the I.W.T. with Police and Guards under the Base Commandant.[1] It must be remembered too that a Base Commandant was in general matters always subject to the French Governor concerned, e.g. The French Governor could limit the hours when troops could be in the town, or the percentage of passes. Civilian interests did not always fit in with military interests. It speaks much for the tact and goodwill of both French and British local authorities that so many years elapsed without serious friction arising.

At the beginning of the War and until December 1916 the command of the Lines of Communication was vested in an I.G.C. (Inspector General of Communications) as described in F.S. Regulations Part II. He commanded the whole of the Lines of Communications and at his Headquarters were established the heads of Administrative Services and Departments, or, in certain cases, their representatives. For the working of these services etc. the I.G.C. was responsible to the C.-in-C.

In December 1916, however, a change took place, owing chiefly to the introduction of the Transportation Department under Sir Eric Geddes. The whole system of command and administration on the Lines of Communication was altered. For the I.G.C. was substituted a G.O.C. Lines of Communication Area, who was no longer responsible for the working of Directorates except as regards:

Accommodation.	Training.
Sanitation.	Discipline and Security generally (e.g. Defence and Fire, etc.)

For all other purposes Directorate Establishments were under their own Directors, who now came under G.H.Q. direct. It is always difficult to serve two masters, and to ensure successful working the dividing lines must be clearly marked and the scheme must be practicable. The responsibility of the G.O.C. Lines of Communication was clearly defined but the practical application was not easy. Accommodation was fairly simple, in as much as no change in the accommodation of Directorate *Installations* could be made by the G.O.C. Lines of Communication Area without the sanction of G.H.Q. Of course as regards the accommodation of the *personnel* of Directorates the G.O.C. Lines of Communication was still responsible. Sanitation, Training and Security presented no serious difficulties as far as Directorate personnel was concerned but the great stumbling block was 'Discipline'. The expression 'Discipline' embraces a wide range and subjects, which seem quite clear and simple, have a disconcerting habit of becoming, under stress of circumstances, matters of 'Discipline'. For instance, the numbers of hours to be worked by the personnel of one Directorate would at first sight seem to affect that Directorate alone, but, when personnel of different Directorates are working together in the same spot, such as Docks, at different time rates, Discipline soon has to play a part. Again, the Demobilization allotment of men of a Directorate is a matter entirely for the Direc-

[1] In the latter part of 1919, Base Commandants were eventually given control of their own Ports (shore work) that is so far as British work was concerned.

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torate to decide but nothing affected Discipline more than this subject. The great majority of the serious difficulties with which the G.O.C. Lines of Communication and Base Commandants had to contend arose from this point.

The officer appointed as G. O. C. Lines of Communication Area when the reorganization took place was Lieut.-Gen. Sir John Asser, K.C.M.G., K.C.V.O., C.B. He continued in this post until the end of March 1919 when he became G.O.C.-in-C. British troops in France and Flanders and was succeeded at L. of C. H.Q. by that well known Gunner Maj.-Gen. Sir H. C. C. Uniacke, K.C.M.G., C.B.

Abbeville[1] was the Headquarters of the Lines of Communication until July 1918 when, under orders from G.H.Q., room being required for the armies which were getting cramped in the vicinity of Abbeville, Headquarters was moved to Pourville near Dieppe. Here it remained until the summer of 1919 when it moved to a hutted camp near Le Touquet.

At Headquarters Lines of Communication there was a small General Staff who dealt with the training at the various Base Depôts, with Anti-Aircraft defence and with Intelligence and Education. Training on the Lines of Communication was, however, ultimately abolished and men were sent up for this purpose to Army Reinforcement Camps and Schools. The General Staff was then reduced. Counter-espionage was always a big and important subject with which the Intelligence branch dealt. 'A' and 'Q' Staffs were of course largely represented.

Each Base had a staff varying in numbers according to the size of the Base.

The administrative staff work was always very heavy. The movements of the armies were always reflected by an enormous amount of work thrown on the Lines of Communication. In the retreat of 1918 forward installations had to be hurriedly withdrawn and re-established on new sites. Labour Companies, Prisoners of War Companies and everyone not required by the armies under the new conditions poured into the Lines of Communication to be accommodated, re-sorted, re-equipped and subsequently re-despatched. When the Allied forward movement began Areas had to be taken over from the Armies and over 200,000 Prisoners of War received,

[1] Abbeville and the neighbourhood had already figured prominently in Englith History. Its name was derived from the Romans who originally established entrenchments there and called the place "Abbatis Villa," The Abbot's House. The swampy district around needed so many bridges that it was called "Provincia Pontiva"—hence its modern name Ponthieu. The port of St. Valery, N.-West of Abbeville, was the scene of Harold's imprisonment by William the Conqueror, and it was from this port that William actually sailed, after being delayed by unfavourable winds, to attack England. In 1272, Ponthieu, with Abbeville as its capital, passed to the English Crown and Edward I. established the tanning industry there. In 1346 Edward III. crossed the Somme at a ford at Saigneville, just West of Abbeville the day before the battle of Crecy; and in 1656 Cromwell's Ironsides were quartered there, having been sent to help Louis XIV. against Philip of Spain, and, incidentally, we are told the inhabitants complained of their conduct!

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organized into Companies, and sent off wherever they were required. When the Armistice came Lines of Communication and Base Staffs were worked at a still higher pressure. Increases in nearly all staffs had to be made to enable the Demobilization Schemes to be dealt with, but it took time to provide suitable officers who had to be furnished chiefly from the resources of armies. The whole Demobilization period was an exceedingly trying time for all Lines of Communication authorities.

Demobilization.

The problem to be faced as regards Demobilization was how to dovetail the resources of the various Ports and Bases into the general demobilization scheme. It was not a question of the requirements of France alone but the needs of troops from Italy and the East had also to be considered. Railway facilities, existing accommodation, and the special idiosyncracies of each Port (such as length of wharves, depth of water, limiting the size of the ships which could be berthed,[1] a difficult point in view of the uncertainty of the shipping which would be available) had to be carefully gone into with each scheme. Multifarious details had to be threshed out before the actual Demobilization Scheme took place, and, as the situation which would exist could not be accurately foreseen, it is not to be wondered at that the scheme was constantly being altered as is narrated below.

As early as January 1917 there was considerable correspondence regarding the construction of Camps at Ports to be used for Demobilization purposes. A Camp built as a rest camp for troops arriving from home, was not necessarily suitable for use on demobilization for troops proceeding to England and whilst demobilization was proceeding the machinery for feeding and supplying the troops in France had to continue.

In April 1918 Calais, Dunkirk, Dieppe, and Havre were suggested as Embarkation Ports but it was not until September 1918 that definite proposals arrived from the W.O. These proposals dated 8.9.18 involved the use of Calais, Boulogne, Dunkirk, Dieppe, Rouen (collecting and staging camp only) and Havre (vide Appendix I.).

To carry out this scheme, leaving out the question of disposal of Remounts—

(a) 4 Camps were required at Boulogne, Calais, Dieppe and Havre (3 clean and 1 dirty at each place*).

(b) 3 Camps of 1,700 at Boulogne and Havre for Colonial and Labour contingents.

(c) Camps at Dunkirk and Havre for Cadres, i.e. skeletons of units which proceeded home to be disbanded there.

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1 **Calais, for instance, could not take large ships. Dunkirk, on the other hand, dealt with almost any size.**

* **NOTE.—A "dirty" camp was the camp into which men arrived and were then deloused and issued with clean clothing. They then were to be passed on to a "clean" camp where they were to remain one night. They might have to remain three days if shipping was delayed, and allowance had to be made for this.**

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Dunkirk was to provide accommodation for—

6,700 Personnel.
2,860 Animals.
1,800 Vehicles.

Havre for—

11,000 Personnel.
6,640 Animals.
2,400 Vehicles.

Camp staffs were allowed for in the above calculations at 13% of the total establishment to be dealt with.

(d) Concentration Camps to hold 1,000 men each were to be made at Dunkirk, Calais, Boulogne, Abbeville, Dieppe, Rouen, and Havre, to take men for demobilization from their respective Lines of Communication Areas.

Bathing and Delousing Schemes had also to be considered.

The figures given above were agreed to with a few modifications.

i.e. Dieppe to read 2,800
Havre to read 7,000

Drafts from Italy and the east not exceeding 3,000 a day were to be taken at camps near Abancourt.

On November 9th Bases were instructed to commence erection of camps as a priority service. Dunkirk's instructions however were modified. They now had to arrange to take repatriated Prisoners of War for despatch to England at the rate of 3,000 a day. 7 Camps each, 100 officers and 3,000 men plus 13% for camp staff were required and were to be used subsequently for demobilization.

Delousing and bathing plants were to be built at Boulogne, Calais, Dunkirk, Dieppe, and Havre. It was calculated that each plant was capable of delousing 200 men in 40 minutes.

To assist Bases in their plans for providing the necessary accommodation it was arranged that, on demobilization commencing, all Base Depôts would be closed except one (for about 1,000 O.R's), and all Hospitals except one at each Base. This plan however never materialized.

On November 10th Cherbourg was brought into the scheme. It was proposed to embark Colonial troops there. Cherbourg was warned to consider requirements for camps each of 3,000 O.R's plus 13% for camp staff. Marseilles was also informed that they were to look out for camps to take 12,000 German N.C.O's who could not be accommodated in England and who were surplus to requirements of P. of W. Companies in France. These orders to Marseilles were cancelled on November 19th, as No. 15 Convalescent Depôt (Trouville) was placed at the disposal of Lines of Communication by G.H.Q., to take 5,000 German N.C.O's, the remainder being accommodated by Abbeville.

On November 20th the orders for Cherbourg were modified, B.W.I. and South African coloured labour only were likely to use this port in addition to demobilization, etc., from Italy.

It was also decided that Abancourt was to be used for staging purposes only.

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On November 19th, Boulogne, Calais, Dunkirk, and Dieppe were informed that they must be prepared to accommodate, in addition, one infantry battalion and Havre was similarly informed on November 26th. On November 22nd, orders were issued that all Demobilization Camps were to be hutted.

Fresh proposals, however, were now drawn up by G.H.Q. (vide Appendix II) owing to changes in the situation. These completely changed Appendix I. Until the plans could be approved, it was impossible to make the necessary preliminary preparations for rail services, accommodation, etc.

In a letter dated 22nd November, the W.O. issued revised proposals, vide Appendix III apparently before the proposals (App. II) had been received. The chief changes were, Calais was not to be used for drafts.

Remounts were to be sent from Dunkirk which involved providing accommodation for 2,500 horses and a camp for 1,000 men, and entailed water being laid on for about a mile, as no site could be found near a water supply. The water supply at Dunkirk presented great difficulties and water barges had to be applied for.

Increased numbers were to be taken at Havre and Boulogne.

Stores for shipment home were to be concentrated at termini of Cross-channel Barge Service. (Dunkirk, Calais, Dieppe and Cherbourg).

Calais was accordingly informed on 26th November that they were eventually to deal entirely with leave. Work on Demobilization Camps there was to be stopped in so far as Delousing Plants were concerned.

On 7th December the W.O. proposals were generally agreed to with a few modifications.

On the same date instructions were received that during Demobilization one General Base Depôt must be maintained at Calais, Etaples, Rouen, and Havre.

On 12th December Dunkirk was instructed that when final Demobilization commenced, 8 camps of 3,000 each, plus usual percentage of personnel would now be required. Other modifications were also made (Appendix IV.)

Meantime on 28th November it had been decided to commence the demobilization of Coalminers and Pivotal men. 1,400 were to proceed to Boulogne every two days to embark at the rate of 700 a day. This was changed the following day to 5,000 to proceed daily from Dunkirk commencing December 15th. Boulogne arrangements were to continue for the present.

This was changed on 8th December to 3,000 from Dunkirk and 2,000 from Havre instead of 5,000 from Dunkirk. On 14th December Boulogne had also to deal with 180 Demobilizers, etc. daily from Third Army. Havre was dealing at this time with Americans, and to enable the Base to deal with Coalminers, the passage of American troops through the port was stopped.

Considerable difficulty was experienced at first by all formations owing to the shortage of demobilization forms.

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On 18th December instructions were received that, except coal-miners, Demobilizers, or Pivotals, nobody from R.A.S.C., R.A.O.C., R.A.V.C. or Remounts were to be demobilized until special orders for each Corps were issued. This was only a temporary measure. R.A.P.C. and Transportation units were subsequently added to the above.

On December 21st it was notified that the War Cabinet had decided that officers and men could be demobilized whilst on leave. This was eventually cancelled on 6th January for all ranks proceeding on leave on and after 12th January, 1919.

On 6th January instructions were received that owing to the critical transportation situation original plans for Demobilisation were to be dropped.

All work on staging camps was to cease.

Rate of demobilisation was to be increased shortly (13th January) to 10,000 a day and to be raised later (22nd January) to 17,000 a day. The Ports to be used, were :—

Boulogne.
Dunkirk.
Dieppe.
Havre.
Rouen.

Etaples had thus dropped out of the scheme. It was, however, decided to continue with the Delousing Plant there in view of future possible modifications. The existing plans for accommodation at the different Bases were not to be modified. Calais was to deal with all leave from 11th January. The figures given below show the detailed allotments.

	Daily. From 13th Jan.	Daily. From 22nd Jan.
Boulogne	2,650	4,000
Dunkirk	3,300	5,000
Dieppe	1,980	3,000
Havre	2,400	3,100
Rouen	1,700	2,000

In addition to above—via Havre :

1,000 Australians (3 days a week).
1,200 Canadians (3 days a week).
1,000 New Zealanders (1 day a week).
200 South Africans (4 days a week).
4,000 B.W.I.
5,000 Chinese.
800 Cape Boys.

Via Cherbourg—3,000 Portuguese a week, and 3 trains daily British personnel from the east.

On January 15th, arrangements were made to send temporarily 500 dispersal drafts daily from Etaples to embark daily at Dieppe. This scheme, however, did not materialize, as trains could not be arranged.

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On January 27th a fresh problem had to be faced by the order that France would receive an increased number of men from Italy and the East for demobilization. A new programme was then drawn up.

Appendix V. gives the allotment to Ports which was to come into force on 7th February. Etaples was again brought into the scheme. To save trains and the consequent demand for trucks which were always scarce it was intended to embark men at Rouen, but as cross-channel ships were not available, paddle steamers were to be utilized. As there was a delay in their arrival, trains had eventually to be provided to take the men to Havre. This necessitated the men being accommodated at Havre which severely taxed the resources of this Base. When the paddle-boats did arrive, it was found necessary to dock them for repairs.

The reduction of reinforcements from home enabled Base Depôts to be abolished from January 25th with the exception of those mentioned below:—

General Base Depôts at Calais, Etaples, Havre, and Rouen
Indian R.A. Advanced Depôt—(Rouen).
Signal Depôt—(Abbeville).
Transportation Base Depôt—(Calais).
A General Base Depôt was also formed at Boulogne.

Since the early part of December 1918, demobilization of certain classes had been proceeding as far as possible. This demobilization caused considerable delay to the construction of camps required for the big homeward flow of troops when demobilization would be in full swing.

The personnel appointed to staff the camps as described below and the labour provided to erect the huts, etc., required was in a state of perpetual diminution by the departure of men for home. The following example gives an idea of this steady drain caused by the demobilization of certain classes. Out of 14 R.E. units provided for R.E. work in Dunkirk Area only 262 men were available for work on 10th February; whilst the 470 Field Co. R.E., which arrived at Etaples on February 2nd for work in connection with demobilization, were only able to provide 11 other ranks for the work.

The provision of personnel for the staffs of camps, etc. was a difficult subject.

The original orders were that the Reinforcement Base Depôt Staffs at the different Bases would be used for staffing the Embarkation Camps. This was, however, found impossible, as the camps were ordered to function before the Base Depôts could be done away with. What was really required was a pool of men for each Base to draw on. G.H.Q. could not, however, provide single units, because Divisions had to be kept intact. They, therefore, placed Divisions (less Artillery) at the disposal of H.Q., Line of Communication to provide all additional personnel required to staff the Embarkation Camps, for the fatigue parties required by Directorates for loading and unloading stores, for assisting escorts (who were themselves being reduced by demobiliation) of Prisoners of War Coys., etc., for the staff of the Concentration Camps of each Base or Area, and to provide Police, etc.

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The 39th Division (Infantry Bdes.) and part of 59th Division were first detailed. Owing to the demands of Bases which varied from day to day, battalions had to be distributed and it was impossible to keep them concentrated by Brigades in well defined Areas.

Changes in the plans then necessitated a further redistribution of some battalions. The result was that their disposal got more complicated. The next difficulty was that some men of these battalions were themselves being demobilized as soon as the scheme commenced. More troops were therefore required. The remainder of the 59th Division and the 30th and 33rd Divisions were sent to the Lines of Communication (all less artillery) and subsequently the 61st Division (less artillery).

It had been customary for the troops in Army Areas to look down on the man at the Base. Troops sent down to help were naturally anxious to maintain their privilege of being classed as fighting troops, and the feeling was so strong that certain formations running embarkation camps had to put up notices to the effect that they were not "Base Wallahs."

In order to simplify the administration by a Division of its troops who were working at the Bases and for other reasons, which need not be gone into here, it was necessary to allot definite areas to the 30th, 33rd, 59th and 61st Divisions.

On February 16th they were accordingly allotted as follows:—
30th Division—Boulogne, and Etaples.
33rd Division—Rouen, Havre, and Trouville.
59th Division—Dunkirk, and Calais.
61st Division—Abbeville, Abancourt, Dieppe, (with a detachment at Cherbourg.)

It was impossible to carry out the moves necessary to concentrate units of Divisions in their respective areas until reinforcements of retainable personnel were available to enable Bases to carry on work of Demobiliation without any cessation of work while the moves took place These reinforcements only arrived by driblets, moreover the numbers were not always known until the drafts actually arrived because in several cases the orders were for 'all available' to be sent. In other cases the numbers despatched were considerably short of those ordered. Further the decision to concentrate P. of W. at Trouville necessitated the despatch of a battalion to that place to carry out the guard duties. This necessitated re-arrangements of the units for Havre, Rouen, etc.

All this time the process of disintegration was causing a shortage of specialists, clerks, cooks, servants, etc., which threw a severe strain on all formations and rendered the task of Bases very difficult. The shortage of clerks at this period when the clerical work was very heavy owing to the number of demobilization returns, lists of Officers for Army of Occupation, for Bonus claims, etc. was perhaps the most serious.

The difficulty of maintaining a supply of cooks for the Demobilization Camps hampered the task of making efficient arrangements for feeding the troops passing through. By the exertions of all con-

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cerned the difficulties were on the whole successfully tackled, although it could hardly be expected that the scheme would run with perfect smoothness. From time to time complaints were received both from Bases regarding the difficulties under which they laboured, and also from outside sources, i.e. letters written to the War Office from individuals regarding conditions at the different Demobilization Camps, etc. The following are instances:—

(a) Embarkation Camps constantly complained of men arriving with Demobilization forms incorrectly made out, wrong Dispersal Areas inserted, wrong forms, etc.

(b) Men arrived with worn-out boots and clothes and incomplete kit.

(c) Men arrived with vouchers for money which they had been told they could get at Embarkation Camps.

The above, threw a good deal of additional work on the staffs of Embarkation Camps and involved keeping the men hanging about a long time at the Camps. The difficulties were further increased by the fact that many officers usually knew little about the composition of their drafts and being themselves for demobilization some did not take much interest in, or exert themselves to look after their men.

(d) The shortage of Demobilization Forms involved writing out MS. Forms, which threw heavy work on the clerical staffs already considerably overworked.

In some cases it was found that men had been kept back from Demobilization by units who had omitted to note the instructions re making out of manuscript forms, and were awaiting an issue of printed forms.

There were also various complaints on such matters as accommodation and food. In some cases these complaints were justified but in the great majority they were, on investigation, found to be chiefly of the confirmed grouser type, and the complainants were obviously unacquainted with the conditions that the Lines of Communication had to face. Briefly these conditions were as follows:—

During active operations, owing to the shortage in material available, and the large demand for stores, huts, etc., the requirements of the Lines of Communication had to be sacrificed to the interests of the Armies in forward areas. The result was that when the Armistice came (Nov. 11th) a great many camps on the Lines of Communication at Base Depôts, etc. were equipped with a large number of tents instead of huts. Duckboards and tentboards were in many cases lacking and for a long period the latter had not been allowed on the Lines of Communication. Transportation difficulties prevented them being sent promptly where they were required, and also caused delay in the delivery of huts Previous to the Armistice these inconveniences were not felt so much, as reinforcements did not stay usually more than a few nights at a Base.

Permanent Staffs at Base Depôts, etc. had been kept at a minimum owing to the shortage of man power, and in the interests of the armies in front. The truck shortage moreover prevented the men being cleared from Depôts, which became congested.

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To prevent overcrowding, the discharge of men from Convalescent Depôts into Base Depôts had to be stopped. Then however, came instructions from home that all Convalescent Depôts were to be cleared by January 2nd. This meant the transfer of some 20,000 men to Base Depôts which had therefore to be cleared first to provide the room. This meant trains were required. Trains could only be provided with great difficulty, and it was essential to load them to their fullest capacity to get the men away.

Altogether it was a somewhat trying time for those in authority in France and especially for Base Commandants. The state of affairs was caused by matters beyond the control of the authorities. The peculiar conditions already referred to resulted in the men being uncomfortable when they naturally expected to have comfort. The shortage of staffs of camps prevented adequate supervision. Officers and N.C.O's many of them inexperienced, were strangers to the men, and the conscripted professional agitator was not slow to seize his opportunity. It speaks well for the good sense of the majority of the men and for the energy of those who were then commanding the Lines of Communication and Bases that the stormy period was successfully weathered in spite of all its difficulties.

The publication on January 30th, 1919, of the new conditions of Demobilization and of increased rates of pay did much to relieve the situation and although the professional agitator worked hard to create difficulties, the men refused to be led astray.

Demobilization went steadily onwards until at last the closing stages were reached. Areas then gradually diminished in number and were either given up altogether or were absorbed into neighbouring areas (for instance Calais absorbed Dunkirk; Brest and Cherbourg were closed down; Abancourt, Rouen, Havre, and Trouville were gradually absorbed by Dieppe; Etaples by Boulogne, and so on).

Headquarters Lines of Communication was finally disbanded October 1919. Bases, which were now called Districts, came under G.H.Q. direct and the work of clearing up was left in the hands of a comparative few. A good deal could be written on this period but it is outside the scope of this present paper. A word of praise is due to the men and women who remained behind. Many of them were anxious to get back to civil life but were indispensable and could not be spared. They had to work long hours, especially the clerks. The efforts made to give them amusement in their leisure moments by sports and dances, at one time called forth indignant comments from wandering newspaper correspondents out for "copy" and from other uninformed individuals.

It would not be right to close this account without a word of praise for the work done by the Q.M.A.A.C. who did yeoman service as clerks, signallers, cooks, etc. and allowed many men to be demobilized. They were themselves all demobilized by New Year's day 1920 except a very few, most of whom were kept for duty with the Graves Department. The loyal devotion to duty of the women of this corps set a splendid example to others, and they were a by no means small factor in bringing a good influence to bear on men, many of whom had a somewhat thankless task during a very trying period.

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They were fortunate in having magnificent Controllers, Deputy Controllers, and other officials who, with no real disciplinary powers, had to guide the women solely by their own individual personalities. The strain on the Controllers, etc. was consequently severe and in many cases resulted in a complete break-down when demobilization came. The honour of the British race was also worthily upheld by the extraordinary bravery shown during air raids by the "Fannies" i.e. women drivers of the F. A. N. Y. (Field Ambulance Nursing Yeomanry) who drove their ambulances with the greatest determination and fearlessness through the streets when air raids were raging The Hun did not spare the northern Ports. Dunkirk had little respite, as it was shelled as well as bombed with the greatest regularity. Calais, Boulogne, Etaples, Abbeville and Blargies were the other chief targets for the Hun aviators, and on one occasion Base Headquarters at Boulogne, which was situated in a hotel in the middle of the town, was completely demolished by a direct hit by a bomb. The astonishing point is how little real damage was done to wharves and docks by these raids

The life of a Base Wallah was not all beer and skittles, although it cannot of course be compared with trench life. Perhaps the great disadvantage, with which the authorities at Headquarters of Lines of Communication had to contend, was the fact that the Lines of Communication was usually looked upon—and quite naturally so—by the authorities in front as the dumping ground for undesirables. The policy of "So and so is quite useless, I recommend him for employment at the Base (sic.)" was not popular with a much-harassed Base Commandant and an overworked staff. Few people realise how much was done by the G.O.C. L. of C. Area and his Base and Area Commandants and how great was the strain on them, especially during the period just after the Armistice, in their endeavours to keep the machinery running with comparative smoothness to a successful conclusion.

NOTE.—The above is not as complete as one could have wished but certain omissions have necessarily had to be made.—F.D.L.

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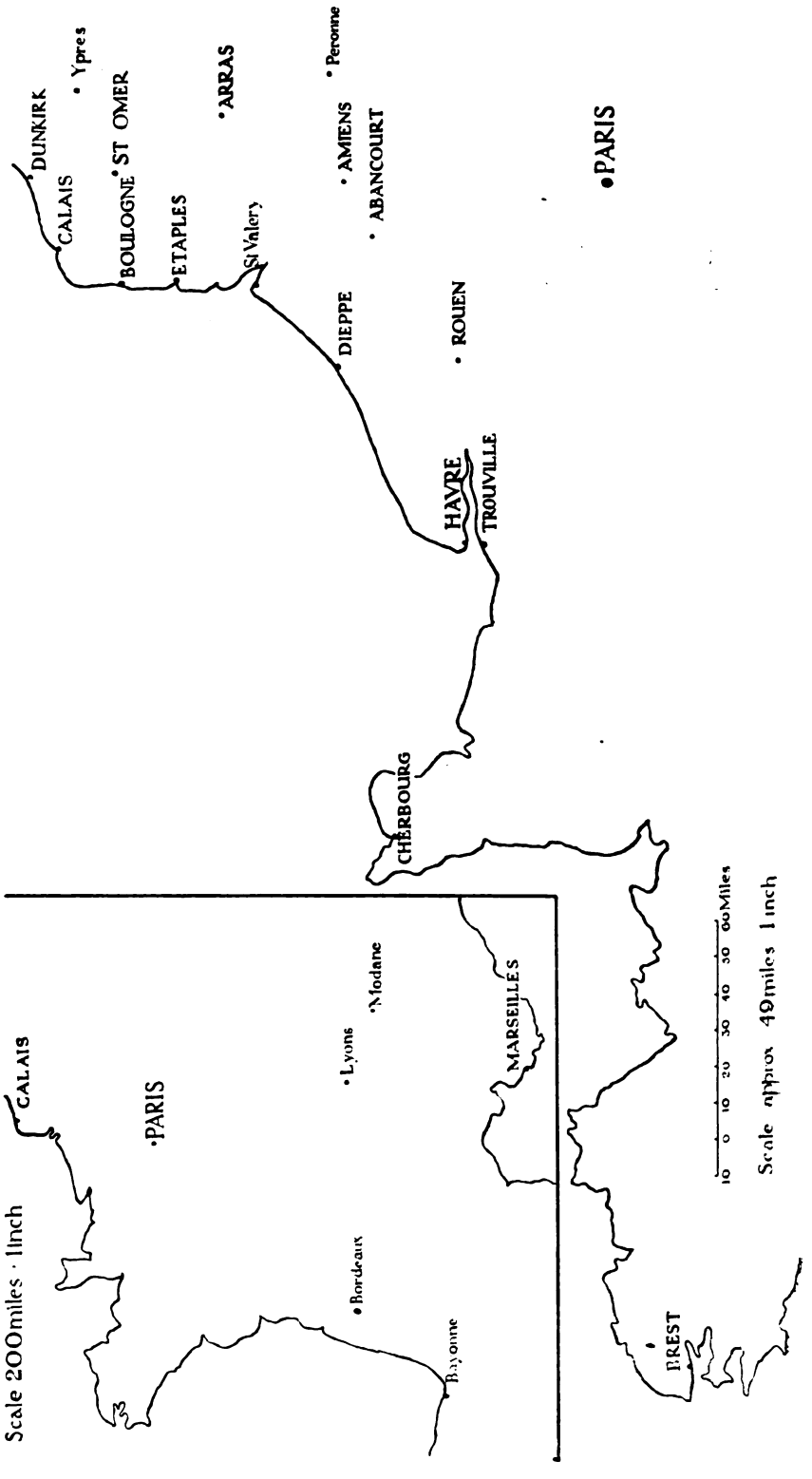

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APPENDIX I. W.O. Proposals 8-9-18.

	Dispersal Drafts Daily.	Bd. Groups Daily	Remounts Weekly.	Remarks.
BOULOGNE	7,400	—	2,500	Plus accommodation for 5,000 Colonial & Labour.
CALAIS	2,800	—	5.000	Plus 3,000 P. of W. (repatriated daily, but accommodation not required.)
DUNKIRK	—	1,500 p. 670 a. 450 v.	—	—
DIEPPE	2,700	—	3,500	—
HAVRE	7,100	3,100 p. 2,600 a. 750 v.	1,500	Plus accommodation for 5,000 Colonial & Labour Contgts.

p.—Personnel.
a.—Animals.
v.—Vehicles.

APPENDIX II. G.H.Q. Suggestions Nov. 19 1918.

	Dispersal Drafts Daily.	Bd. Groups Daily.	Remounts Weekly.	Remarks.
BOULOGNE	4,200	—	2,500	Plus Leave (Proportion.)
CALAIS	3,200	—	5,000	Plus Leave (Proportion.)
DUNKIRK	2,800	2 Bd. Groups	—	Not more than 600 vehicles a day.
DIEPPE	5,000	—	1,300	
HAVRE	4,200	—	3,500	Plus Colonial Drafts.

APPENDIX III. W.O. Proposals Nov. 22 1918.

	Dispersal Drafts Daily.	Bd. Groups Daily.	Remounts Weekly.	Remarks.
BOULOGNE	7,200	—	1,700	—
CALAIS	—	—	1,500	—
DUNKIRK	3,000	1½	3,500	Plus 3,000 Repatriated P. of W.
DIEPPE	2,800	—	1,500	—
HAVRE	7,000	—	4,300	Plus Colonials.
CHERBOURG	—	—	—	Coloured Labour.

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APPENDIX IV. 12 Dec. 1918.

	Dispersal Drafts Daily.	Bd. Groups Daily.	Remounts Weekly.	Delousing Stations.	Remarks.
BOULOGNE.	4,200	—	1,700	TWO	
CALAIS	—	—	1.500	—	Leave only.
DUNKIRK	3,000	1½	3,500	THREE	
DIEPPE	2,800	—	2,800	TWO	
HAVRE	4,600	—	3,000	THREE	Plus 2,000 Colonials and Colonial Cadres.
ROUEN	2,400	—	—	ONE	
ETAPLES	3,000	—	—	TWO	Embark Boulogne.
CHERBOURG	—	—	—	—	Portuguese and Coloured Labour

APPENDIX V. 7 Feb. 1919.

	Shipping daily for	To be despatched daily.	Remounts Weekly.	
BOULOGNE	6,500	4,450	1,700	Embark at Boulogne. Leave.
ETAPLES		2,050	—	
CALAIS		—	1,500	
DUNKIRK	6,500	6,150	3,500	
DIEPPE	3,000	3,000	2,800	
HAVRE	5,000	4,950*	3,000	*i.e. 4,600 British from Havre and 350 from Rouen Plus 1,000 Australians and 1,000 Canadians, 3 days a week. Also deals with Chinese, Cape Boys, and B.W.I.
ROUEN		350	—	via Havre, plus 1,000 N. Zealanders via Havre on Sundays.
CHERBOURG		—	—	For Portuguese Drafts from Italy and the East to be diverted to HAVRE 8th Feb.

Staging Camps at BUCHY and ABANCOURT for 6,000 and 3,000 respectively.

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VON KLUCK'S WOBBLE ON PARIS.

By Major A. H. Burne, D.S.O., R.A.

NO campaign will ever surpass in interest for Englishmen the opening stages of the World War in northern France. In this campaign the march of von Kluck on Paris will hold a pre-eminent place. As is well known von Kluck has himself written an account of his march which has been recently translated into English, and published at the moderate price of 10/-. This book is destined in its way to become a classic, in my humble opinion. It paints a wonderful picture, indirectly, of the man himself, and it gives so far as we can tell a remarkably accurate account of the operations. None of the essential facts in the book have been discredited, or even called in question, though there are some omissions, and some matters which are slurred over, these gaps in the story have been filled in from other sources.

At the present juncture the book is absolutely essential to anyone who is studying the campaign, and it is probable that it is being widely read by officers working for promotion. True, the War Office have recently issued a memorandum on the subject of the promotion examination, in which the only source of information mentioned is the despatches of Sir John French. But it is quite obvious that the War Office does not contemplate officers confining their studies to our official despatches. To appreciate the lessons of the war it is necessary to know the intentions and objects of both the protagonists. And in the above named book the intentions and objects of one of the protagonists are very clearly and authoritatively exposed. The book, so far as it affects the operations of the British Army falls naturally into three parts.

Part I. The Mons—Le Cateau operations, in which vonKluck imagined he disposed of the British Army.

Part II. His march on Paris, ignoring the Contemptibles.

Part III. His retreat, after he had discovered his mistake.

It is proposed in this article briefly to touch upon the 2nd part of the book. The object is not that of a commentary but an elucidation of the actual facts for the benefit of prospective readers, preparatory to reading or studying closely the book itself.

So far I have only mentioned the *book*. But there is something if possible equally valuable, that is the *map*. It is a really wonderful map. It is packed with information, but like most maps that are packed with information involving the movements of troops, it tends to obscure and fails to emphasize the salient points.

I have accordingly constructed a map, to the same scale which is designed with the object of showing the general trend of the movements of each corps from day to day in the period dealt with in Part II, namely: from the night of August 28th to the night of

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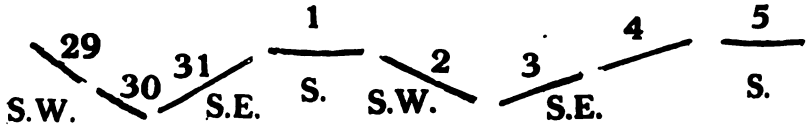
September 5th. In order to do this I have throughout used a single line to indicate the march of a corps, although in most cases the two divisions which comprised the corps marched on different roads. In this case the line shown on my map is drawn as near as possible *between* the two roads. In the case of the IX Corps the movements of the 17th Division (which was lent to the 2nd Army) are not shown until September 1st. The movements of the Cavalry Corps are also omitted, for the sake of clearness. It flitted about between the right flank and the centre, and the only times when it showed up prominently were (1) *September 1st*, when its attempted reconnaissance on Paris was rudely disturbed and frustrated by the glorious action at Néry, and *September 5th* when it made a dash for Provins and the Seine.

Its influence during this period was almost negligible.

In reconstructing the map I have another object. The popular idea of the march of vonKluck is that he marched direct on Paris, but at the last moment suddenly changed his mind, and slid off to the south-east. This map is designed to show that so far from this singleness of aim the 1st Army Commander showed a surprising infirmity of purpose, and so far from marching direct on Paris, he made no less than five alterations of direction, marching successively South-West, South-East, South-South-West, South-East, South. As an *aide memoire* for students he may be said to have described a capital W, in wobbling from one side to the other, and as W is the first letter of *Wobble* it is perhaps a useful one to remember the shape of his march by. Put in diagrammatic form it would appear something as follows, the date being placed above the line of march, and the direction below:



We can now study the map itself, which appears opposite page 440.

Opposite the map, and level with each day's advance as shown on the map, are given the general direction of advance, objective, and attitude or orders of "OHL" (which stands for "German G.H.Q.").

The problems which faced von Kluck and the methods by which he solved them in his five successive changes of direction are—to quote Major Cherry's arresting article in the September Journal—"of absorbing interest" involving as they do numerous interesting speculations and points of strategy: but they are outside the scope of this article, which is confined to an elucidation of the accurate ascertained facts, perhaps a dull, but certainly a necessary prelude to a study of the strategy of the campaign.

To confine ourselves then to facts: the map discloses the following points of interest, amongst others:—

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1. The short advance on the 29th of August, which can be attributed to the resistance put up by the French Reserve and Territorial Troops of General Maunoury's Army.
2. The tremendous march of the III and IX Corps on August 31st (30 miles).
3. The effect of the action of Villers Cotteret on the advance of the troops affected (the III Corps). They only advanced six miles on September 2nd (the day after the battle).

   Our rearguard, as a matter of fact, waited for hours for the Germans to come on, but waited in vain.

   A diary of an officer concerned written at the time reads for Sept. 2nd "The enemy did not press the pursuit to-day."
4. The way the IIIrd and IXth Corps hung together throughout the advance. The only occasion when they separated was on September 2nd, when the IX Corps pushed right on to Chateau Thierry. This however was not contemplated in von Kluck's orders.
5. The healthy respect shown for the entrenched camp of Paris, by the respectful distance they kept away from it. Whether this respect was justified one begs leave to doubt after reading General Gallieni's Memoires (admirably reviewed in the "Times" Literary Supplement, of September 17th). During the battle of encounter on Sept. 5th, IV advanced beyond Penchard, but retired after dusk, according to von Kluck "in order that they should not come within effective range of the Paris forts." The French claim to have driven them back.

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A HISTORY OF ARTILLERY.

PART IV.

1783 TO 1815: QUO FAS ET GLORIA DUCUNT.

By Ralph Flenley.

(Continued from page 348).

IT will be simplest to follow the course adopted in the last chapter and notice first the growth of the regiment, then the broad features of its use during the period, winding up with what can but be a precis of the work of the British guns and gunners in the military operations of these eventful years. We left the regiment after the peace reductions with a total strength of four battalions, counting 3302 all ranks. The establishment remained almost unchanged until 1791 though the strength of the companies was raised in 1787. Two separate and unattached companies were raised for service in the East Indies in 1791. A more important development came in January 1793 when after much consideration of various suggested plans, two 'companies', which quickly became troops, were raised for service with cavalry, the beginning of the Royal Horse Artillery. "Only four guns per troop were granted at first; and the establishment consisted, in addition to the officers, of 8 non-commissioned officers, 49 gunners and 35 drivers. On the formation of C and D troops, on 1st November 1793, the armament of each troop was raised to 6 guns and the establishment per troop was 14 non-commissioned officers, 85 gunners, 45 drivers, and 187 horses".[1] The provision of R.A. drivers was of course a most important step, not merely for the efficiency of the troops themselves but also for the added strength it gave to the case for their regimentation in the battalions. To these four troops others were added within a few years two, E and F, being formed in the next year. G, H, I, K, L, and M, were raised within the next eleven years and the two Rocket troops in 1813. This made fourteen troops in all created before the end of the war; seven were reduced after the peace. Meanwhile the battalions had also increased. In the first year of the war the strength of the 'marching companies', as they were called, was increased by 24. In the next year the Fifth Battalion was made, of five companies, receiving another five companies in the succeeding year. In 1799 came the Sixth Battalion, made by adding six companies to the two earlier raised for the East Indies. The Union with Ireland saw the end of the Royal Irish Artillery as a separate regiment and the formation from it of the Seventh battalion. The

[1] Duncan, ii. 35.

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peace of Amiens in 1802 brought proposals for reduction but they were not carried out. Instead with the re-opening of hostilities in the next year came the addition of the Eighth Battalion, giving the regiment a total strength, including the Horse Artillery Troops, of nearly 9,100 men. By the end of 1805 its strength was 11,760, the major part of the increase having been caused by the formation of the Ninth Battalion. A Riding-house Establishment was added in 1806 and early in 1808 the Tenth and for the time the last Battalion was formed. A detailed statement of the strength of the artillery in 1810 may be found in the pages of Duncan;[1] a return of two years later shows over two thousand horse and well over fifteen thousand 'foot' artillery. At the end of the Peninsular War the numbers fell, rose again for the Waterloo campaign and fell again after the great peace, this time for a long period. The raising of Volunteer companies of artillery in the early years of the war and the taking into the English service of several companies of French emigré artillery need not concern us. But the services of the artillery of the King's German Legion and of the Portuguese batteries in the Peninsular War made a very real addition to the strength of the British in that arm during the war.

The formation of a Driver Corps in 1794 was a step, if a short one, in the right direction. Instead of the civilian waggoners hitherto thought good enough, save by artillerymen, for the transport of guns and wagons, soldiers were regularly enlisted for this purpose. It is easy to see, looking back, that the creation of a separate corps whose members were doing artillery work yet were not under artillery officers, could be but a temporary and unsatisfactory expedient. A slight additional step forward was taken in 1801 when the Gunner Driver Corps as it now came to be called, was more definitely organised and attached for service with the marching companies. Yet is was not until 1817 that the drivers were placed under R.A. officers and five years more before they were enlisted into the regiment, and the corps of Royal Artillery Drivers as it became in 1806 ceased to exist. It had naturally grown with the Regiment during the war. By 1802 it contained seven troops each of three officers and 210 other ranks with a total of 2,478 horses. Another troop was added by 1808 and three more by 1810 when the establishment included 88 officers and 6017 other ranks with 11,320 horses, near which its strength remained for the rest of the war, being reduced after the peace. The Driver Corps came in for a good deal of reviling during the war from artillery officers and others. The composition of the corps does not seem to have been of the best; the drivers were reported in 1796 to be "generally old men, boys and cripples, people totally unfitted for active service", far from the severest of the criticisms passed upon them. Yet obviously when the drivers were in so anomalous a position difficulties were bound to arise. On active service efforts were made to overcome the defects of the system, as for example by a battery commander in the Peninsula, Captain Cairns by name, who practically incorporated into his battery the drivers attached to him. Colonel Dickson, commanding the artillery in the Peninsula,

[1] Vol. ii, p. 263.

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placed gunner officers over the pontoon train, then under his care and horsed by the Driver Corps, for the sake of the horses. It is in fact difficult to see why the formal incorporation should have been delayed so long.[1]

Another development made the more necessary by the growth of the corps and the long continued wars was the creation of a Headquarters Office, which should act for the regiment much as the battalion headquarters did for the company, and provide a channel between the Board of Ordnance and the battalions and troops. A Brigade Major in the person of Captain John Macleod was appointed in 1783. In 1795 he became D.A.G. The value, indeed the necessity of such an office soon became clear, in no small measure from the zeal, skill and tact of Macleod himself. We find Brigade Majors of artillery on active service in the later campaigns of this period and General Officers of the Regiment in command of the artillery abroad, the first being General Farrington for the expedition to Holland in 1799. Even with the addition of the new link or wheel between Regiment and Board in the person of Macleod, we find a good deal of criticism not to say abuse of the Honourable Board both in peace and war during this period, much of it not without justification. Beyond the mere officialism of its methods which was natural if not inevitable, the Board was sometimes responsible for, if it did not itself commit, serious faults and delays in the provision of ordnance supplies for brigades on active service abroad. It apparently provided howitzer carriages for the 6-pounder guns with the Egyptian Force in 1801 and took some time in the Peninsula War to appreciate the necessity for supplies of such simple necessities as horse shoes or spare parts of any kind. As late as 1813 the Board sent out with a siege train to Spain ammunition for only one day's firing, though in general it must be said that the Board had improved since the days at the beginning of the war when the request of a Commander-in-Chief, the Duke of York, for a siege train, could be mislaid for weeks without any attention being paid to it.[2]

Yet during the early years of this period, in particular before the war, the regiment was apparently in no position to throw stones at the Honourable Board. Beyond deficiencies in organisation which were no fault of its own, the regiment had for a time, in the eyes of contemporary observers, lost some of the quality which had formerly distinguished it. A measure of the decline could be attributed to the Board itself and in a wider view to a similar decline in the army as a whole where the decade between the American and French wars was marked by "appalling" desertions, great difficulty in securing recruits and a falling off in discipline. The soldiers' pay, be it remembered, was inadequate, like the sailors', before being increased in 1797. The artillery had unquestionably gained in the efficiency of its officers during the century by its escape from the "purchase" system; the sale of the only two offices so transferable, those of Adjutant and Quartermaster, was abolished in 1783. Further whilst

[1] There is an account of the R.A. Corps of Drivers by Col. J. C. Dalton, in Min. Proc. R.A. Inst. xxviii, 1901-02, p. 319 seq.

[2] History of the 13th Battery, R.F.A., Major J. Marriott Smith, 1913; Duncan, ii, 249; Frazer's Letters; Fortescue, Hist. Brit. Army, iv, i, 225.

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it counted, and still counts as some of its most esteemed names, men who had risen from the rank of matross to Colonel Commandant, the existence from so early a date of the Academy had given to the corps a succession of officers whose training in their arm was naturally superior to that of other regiments. We may, however, hazard a guess that the shortage of officers in the American war, already referred to, which had caused cadets to be commissioned far more quickly than was normal, brought certain disadvantages with it after the peace. The pay of the subaltern officers was hardly less inadequate than that of the men, promotion was still slow and there were no horses or drivers to provide useful occupation, all of which probably contributed to the decline. It was in any case only temporary. With the war came revival and long before its close the reputation of the corps was higher than it had ever been, both with the army and nation at large as with foreign observers. Foy, the French general, who had seen the British artilleryman both in the Peninsula and at Waterloo, writing in 1817 remarks on 'le bon esprit qui les anime', as well as on their keenness, skill and courage in battle.

Turning to more concrete if not more real or important things, for the dress of the corps during this period, more complicated by the addition of the horse artillery, we must be content with referring to the pages of Duncan and Macdonald.[1] In regard to ordnance, a period of such long continued war and that on so large a scale, and bringing as we have indicated, such an increase in the size of the corps, might have been expected to produce more advance than actually took place. Yet without seeing any such decisive development as that of a rifled gun the period saw a good many minor changes of importance. From the nature of the operations engaged in, these were more marked in regard to light than to heavy guns, though all ordnance alike shared in the application of some of the results of the Industrial Revolution. Amongst these may be mentioned the improvements in chemical and metallurgical processes which gave equal strength for less weight in guns and better and stronger gunpowder; the iron 18-pounder of the Peninsular War was more than equal, it has been estimated, to the 24-pounder of the Seven Years War, in range and power. There came, too, experiments with the telescopic sight in 1793 to 1795; the trial in 1792 of a rifled gun, which failed, in part because of the lack of an elongated shell; the limber hook and block trail likewise appeared during this period.[2] The American war had temporarily restored the 3-pounder as the field gun but the return had been due to the special circumstances of fighting there and hardly affected the practice in Europe. Some 3-pounders were used: the first two troops of horse artillery had two each for a very short time, they were also used in the early and later stages of the Peninsular War, as in Egypt in 1801, whilst some 4-pounders, French or Italian guns, were used in Italy in 1806. The light gun of the period however was the light 6-pounder. It was the most useful and most common horse artillery gun then and indeed long after, though we find 9 and even 12-pounders used on occasion during these wars. Nor was the use of the

[1] Duncan, ii. pp. 21, 22, i, 42; Macdonald, Plates ix, x, xii, etc.

[2] Hime, in Mins. Proc. R.A. Inst. viii, 1874, p. 285.

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6-pounder confined to the H.A. troops; field batteries, then termed (foot) 'brigades', were likewise frequently armed with it, a common equipment for a battery including one 5½ inch howitzer to five 6-pounders. There were still too many varieties of guns heavy and light and the companies in particular were liable to change the calibre of their guns from 6 to 12-pounders, or indeed to 18 or 24-pounders, heavy howitzers or mortars, in what must have been a most bewildering if not annoying fashion and one which did not make for efficiency. The battalion guns before they disappeared were normally 6-pounders. There was a clearly marked demand in the Peninsular War for heavier guns to reduce the advantage the French enjoyed in that respect; a troop was given 9-pounders in exchange for the 6-pounders it had brought from England, and 18-pounders were requested for field as well as for siege operations; the 18 pounder was still the heavy field gun at Inkerman.

In regard to ammunition the importance of the introduction of Shrapnel or, it was more often called then, spherical case, needs no urging. It came as a successful attempt to combine the use of fuzed shell in guns, tried in the siege of Gibraltar, with the superior bursting effect of case, which latter it partially ousted. Made by Colonel Shrapnel in 1784 it was not tried in the field until twenty years later. Successfully employed at Vimeiro, it came more and more into demand as the Peninsular War wore on, Wellington approving of it as much as artillery officers. The same thing cannot be said of the Rocket, which the Duke disliked, and history has endorsed his judgement. These were the invention of Colonel Congreve. They were used a little in the Peninsular war, with some success, Napier tells, at the battle of Toulouse, though he described them as "projectiles which, like the elephants in ancient warfare, often turn upon their own side." But probably their best known service was at the battle of Leipsic where some Rocket Detachments, formed whilst there into a Rocket Troop, under Captain Bogue, used their weapon with excellent effect. We need not discuss their good and bad points which are obvious enough, for their part, if striking, was naturally subsidiary to the more solid effects of round shot, shrapnel, shell or grape.

In the use of artillery during this period we may discern, in summary, two outstanding features, both of them predominatingly French in origin. In the first place the Revolutionary armies with their freedom from earlier and more rigid traditions in drill, and battle manœuvre, with their organisation of the division of the three arms as the fighting formation, their dependence on local foraging for supplies and their development of skirmishing infantry, caused the divorce of the artillery from the close union with the lower infantry units whose movements they were unable to follow. This meant the end of the "battalion gun" and the grouping of the artillery in larger units, batteries or groups of batteries, more completely under the control of artillery officers. But the disappearance of the battalion gun did not mean that the artillery had become less mobile: on the contrary it was the better able to respond to the increased demand for a mobile field artillery, most obviously in the general demand for and use of horse artillery, but no less certainly

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in the development of the 'field' guns proper. Napoleon, an artillery officer by training, carried the development a little further, helped by the skill of men like Sénarmont and Drouot. Massed artillery was no new thing in European fighting. But the concentration of fire from artillery which being mobile, could be massed fairly quickly on the point or points selected for breaching the enemy line by the close columns of infantry, and the co-ordination of arms implied therein, were in essence the contribution of Napoleon, in this as other things, 'the child of the Revolution.' "The artillery of my Guard decides most of my battles, because having it always under my own hand I can move it wherever it is required", he said on one occasion. And again, "When once the combat has grown hot, the general who has the skill to unite an imposing mass of artillery suddenly and without his adversary's knowledge, in front of some part of the hostile position, may be sure of success."[1]

We cannot afford the space to illustrate Napoleon's use of artillery in his battles or to qualify a generalised summary open to the criticism of all such generalisations. In looking at the way in which England responded to the influences of the dominant military nation of the period, it must be premised, not for the first time, that England being first a sea power, her efforts on land were far more limited than those of France. Even the Peninsular War, important as it was in its general results, was a minor war to the Emperor, and did not after 1808, draw him across the Pyrenees. We naturally do not find such masses of guns employed, nor such marked effects produced, as where Napoleon's 'big battalions' moved and fought. None the less the long years of war saw very marked if slow development. In England, as in France, the battalion guns disappeared. In France they had gone, or almost so, when England entered the war, but the latter country used them in the first campaign in Flanders in 1793. There was however a visible tendency to 'brigade' them in batteries. This was definitely done in the 1799 campaign in Holland when they were grouped in four gun batteries, and the battalion guns of the Royal Irish Artillery were 'brigaded' the same year. By the time the Peninsular War began the field artillery was universally grouped in batteries, then called 'brigades', of six guns normally though four 12-pounders frequently made a battery and of course sections were detached for use from time to time. Similarly it was in the Peninsular War that with the development of the Divisional organisation, the field artillery took its place in that formation, the allotment in Wellington's army being one battery for each division, the horse artillery with the Cavalry and Light Divisions, any additional artillery available forming a reserve. The French Divisions opposed to Wellington in 1812 had three of four batteries each.[2] The siege artillery, with no such continuous demand for its services as the field found in the Peninsula, and of course not yet separated in any way, saw least growth in this period, largely because of the very lack of permanent attachment to it of any part of the regiment. It is true that hardly a year of the war passed without siege operations of some sort being undertaken, from those against Dunkirk in the first year

[1] Qu. Oman, Peninsular War, i, 120.

[2] Fortescue, viii, App, pp. 632, seq.

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of the war to the siege of San Sebastian near its close, and they were carried on in almost every country and climate. Yet from the nature of the fighting sieges do not loom so large and were actually less decisively important on the whole than they had been to preceding generations.

The brigading of the battalion guns gave more independence to the light artillery but not, for a time, much increase in mobility. That however had meanwhile been supplied by the appearance of the horse artillery whose very *raison d'etre* it was, since they were to act primarily, though far from entirely, with the cavalry. For a short time, it must be confessed, the very success of the horse artillery looked as if it would check the development of mobility in the 'foot' or 'marching' artillery. When, as frequently happened in these years, both troops and companies had the same gun on active service, the latter had no fire superiority to offset their slower movements, and commanders naturally preferred the more mobile 'troop' when they could get it. Of vital importance was the fact that the horse artillery had their own drivers whilst the companies had to depend on the services of another corps for their movements. And the high standard aimed at and attained from the first in the Royal Horse Artillery helped to give it an advantage. The pathetic account of an inspection held at Woolwich after the war had been going on for five years shows how much leeway the future 'field' artillery had to make up. "The guns were each drawn by three horses in single file, which were driven by contract drivers on foot, hired for the occasion, dressed in white smocks with blue collars and cuffs, and armed with long carters' whips of the ordinary farm pattern. When this formidable array had been reviewed, the Commandant, General Lloyd and the Garrison Adjutant, expressed their joint opinion that field artillery movements could not be performed quicker".[1] Yet these field guns had galloped into action forty years earlier. As the war went on however the situation improved markedly, in the long run helped rather than hindered by the horse artillery since the two remained most closely connected, not least by the transference of officers from one to the other. The substitution of double for single draught alone made practically universal save for mountain guns by the Peninsular War, marked a long step forward, and the improvement of the ammunition wagon and the seating of the gunners there and on the gun limber was another necessary move. Before Waterloo the field batteries had reached a degree of mobility undreamt of at the beginning of the war. "The English", said an expert French opinion in 1818, "have made the field batteries a new arm".

The bare recital of the time and place of the occasions on which during these twenty-two years of almost continuous war the British artillery was engaged would take more than the short space available. It is therefore only possible to glance at the different theatres of the war particularising briefly those occasions which best illustrate the use of artillery, not attempting to follow chronologically or indeed otherwise the course of the war. Until we reach the Peninsular War the military effort of England was made up for the most part of

[1] Hime, The Mobility of Field Artillery, Pt. iv, Mins. Proc. R.A. Inst., viii, 1874, p. 216.

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isolated enterprises scattered over widely separated theatres and with little or no continuity. Looking first at the operations which nearer home began the war, the record of the Flanders fighting of the first two years is more instructive than pleasant, for the artillery as for the the army as a whole. The battalion gun system was in full force, mobility had rather declined than advanced, there was a shortage of trained gunners, indeed of artillerymen of any sort, as of equipment; discipline, as we have seen, was not of the best, horses were short, the drivers were not yet regimented until the second year of the war and the lack of siege materiel for the siege of Dunkirk showed that the Board of Ordnance was far from efficient. Of wider import, the almost inevitable disunion of counsels between Austrians, Prussians and English, and the adherence to the "safe" and more formal methods of carrying on the war, played into the hands of the Revolutionary forces. Beginning with one company, the British artillery in Flanders rose to six companies in the second year of the war. In the campaign of 1793 the battalion guns with the Guards were engaged at Famars and again at Linselles, and the major part of it at the siege of Valenciennes which, conducted with all the formality of an earlier age, presented no special features. That of Dunkirk was less fortunate, being perforce abandoned with the loss of the 32 heavy guns painfully obtained for it from a frigate, after a fortnight's very imperfect siege. The second year there brought more promise but less fulfilment. In an engagement of 17th April one company of the regiment, No. 1 Company 4th Battalion, did so well that the Commander-in-Chief, the Duke of York, "made the whole army form up on the field of battle while this company marched past him".[1] It was a minor engagement but the incident is of interest as shewing that the artillery was beginning to regain the prestige it had earned during the two preceding wars. Nine days later the guns made a modest contribution to the dramatic cavalry success at Beaumont by demonstrating in front whilst the horse worked round the unguarded French left, helping also to drive another body of the enemy out of the village of Troisvilles. The movements of the next month are far too complicated to follow nor did the guns play so great a part in them, though they had their share in the losses of 18th May, when some guns were lost, with heavy casualties to the gunners from French cavalry in the confusion of the retreat from Roubaix eastwards. In the later misfortunes and tragic end of the campaign there is nothing of specially artillery interest save the common memory of a retreat which in its final stages in midwinter equalled if it did not surpass in misery any other in which the regiment or the army has ever had a part.

Between that failure and the success of over twenty years later which may be said to have retrieved it there came a number of other expeditions to this part of the continent, as well as a number of coast raids. About a company of artillery went with the belated expedition to assist the Vendeans, going on to the Low Countries afterwards; others had been to Toulon in the same year; others again shared in the futile expedition to the Isle D'Yeu in 1795, and a company went with the small force under Eyre Coote to block the

[1] Duncan, ii, p. 61.

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then new Bruges—Ostend Canal, with detachments on the bomb vessels which accompanied the force. Its work done, the force was unable to re-embark because of the roughness of the sea, and after a fight with superior forces on the sand dunes the guns were spiked and thrown into the sea before the capture of the whole force. Not essentially dissimilar in character to these raids was the expedition of 1799 to Holland, to free at any rate the northern part of that country from the grip of the French. As the expedition might expect to have siege as well as field operations to perform the artillery was unusually large in amount. In addition to thirty 6-pounders for the battalions, there were 18 and 24-pounders, 5½-inch howitzers and 8 and 10-inch mortars, 131 pieces in all. Of no less interest was the inclusion for its first active service abroad of "A" or The Chestnut Troop of Horse Artillery. A more unkindly test could hardly be conceived, from the nature of the operations and of the country with its sandhills and innumerable ditches. Nor were they particularly happy in the armament given them which was made up of 12 and 6-pounders and 5½-inch howitzers. It was the more credit to them that they earned good opinions. With the reinforcements which followed Abercromby's force the marching companies were increased to no less than eight, with drivers in addition, to a total force of nearly 50,000 men. This was far the largest body of artillerymen the regiment had so far sent with an expeditionary force. But far more had been achieved with much smaller forces. Between the sandhills near the coast and the ditches which enclosed the country inland, there was no great opportunity for artillery work in the fighting which took place. In the action of 19th September the British captured and destroyed sixteen French guns but the Russian allies on the right lost twenty-six. In the battle of a fortnight later two guns of Major Judgson's troop sent forward with the cavalry advance guard of the right column, were caught and charged by the French Hussars, captured, not without some loss and recaptured by a spirited charge made by their escort of the 15th Light Dragoons. But neither then nor later was any material advance south made. The only real achievement of the expedition, the capture of the Dutch fleet, had been made within three days of landing.

To be concluded.

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SOME EPISODES DURING BATTLE-FIGHTING ON THE WESTERN FRONT.

Communicated by

MAJOR-GENL. SIR H. C. C. UNIACKE, K.C.M.G., C.B.

XL. Action fought by the 84th. Battery R.F.A. on the 25th. April while attached to the IX French Corps.

The battery belonged to the 11th Brigade, R.F.A., one of the old Regular Brigades which had come from India in 1914 and had in course of time become an "Army" brigade. It had been in action on the Ploegsteert front when the Germans broke through on the 10th April 1918, and since that date had been covering the British retirement. The batteries of the brigade were therefore tired out by a fortnight's continuous rearguard fighting and consequent loss of sleep, and had also suffered many casualties.

About three days previously the French had relieved the worn out British troops on their front but two Army brigades, the 11th and 35th, were left in action and placed under the IX French Corps —a fine body of men, who had been resting for some time, and so were absolutely fit and spoiling for a fight.

When night fell on the 24th April the 84th Battery was in action about 50 yards behind the crest of Mont Rouge, and about 250 yards south of the site of the windmill which used to be such a prominent feature on this hill. The battery was covering the 83rd French Regiment of Infantry which was holding the eastern edge of Dranoutre Village, and had five guns in action, one ("F" Sub-Section) being in the wagon lines undergoing repair.

At 2 a.m. on the 25th the Germans suddenly opened a most intense bombardment of the front area and the battery positions in this neighbourhood; they had concentrated an exceedingly strong force of heavy artillery with which to bombard the commanding positions of Kemmel, Mont Rouge, and Mont Noir; the occupation of which would be an asset to them of the greatest value in clearing a passage towards Calais and the coast. The German guns were massed behind the Wytschaete, Neuve Eglise and Ravelsburg ridges —which formed a sort of horse-shoe round the front covered by the battery.

The 84th Battery, and two French batteries of 75's a hundred yards away on its right flank, were the two most forward batteries in the area—the remainder of the French and British batteries being in the deep valley between Mont Rouge and Westoutre, to the flank and rear on Mont Vidaigne, or behind the Scherpenberg.[1]

[1] NOTE:—"D" Battery of the 11th. Brigade was nearly as far forward as the 84th. Battery, but it was away on the right flank in front of Mont Vidaigne and consequently got off lighter.

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The German bombardment consisted largely of gas but the 84th battery being on top of the high ridge of Mont Rouge did not suffer so heavily in this respect as the batteries located in the hollow in rear.

At 2.20 a.m. S.O.S. rockets were sent up by the infantry and the battery at once quickened its rate of fire, slowing up again, however, after about twenty minutes as there seemed to be no further developments. The enemy's bombardment was maintained at its full intensity until 8.30 a.m., when the S.O.S. rockets went up once more and the Germans attacked with the infantry of their Alpine Corps which had been specially brought up for the occasion.

By this time two guns of the 84th Battery had been knocked out, so fire was increased to S.O.S. rates with the three remaining guns. There had been a sharp little action during the night of the 23rd—24th in which one gunner had been killed and Lieutenant T. J. Moran and two gunners wounded. During the recent rear-guard fighting Lieut. J. R. Walker had been captured, and Lieut. H. Hodgson killed. Lieut. A. H. L. Hamilton was acting as brigade F.O.O. on this day, so there remained for duty with the guns when the action began only the Battery Commander, Major W. W. Green, D.S.O., M.C. and Lieut. W. Howe. By 10 a.m. thirty-four casualties had occurred amongst the gun detachments, and only two guns remained in action. 'D' gun had its off wheel blown off and its spring case smashed, its detachment were all either killed or badly wounded with the exception of the No. 1, Sergeant Tracey, who was untouched. He immediately went over to "E" gun, most of whose detachment had been knocked out. A 5·9 shell detonated on the trail of "C" gun—the acting No. 1, Corporal Davis escaped by a miracle, but the remainder of the detachment, including Lieut. Howe who was acting as No. 2 at the gun, were all killed.

All the original Nos. 1 had now been seriously wounded, except Sergeant Tracey who seemed to bear a charmed life, and the battery was left with one officer, one sergeant, two corporals and five men, the latter being the cooks and officers' servants, to man the two remaining serviceable guns.

The two French '75' batteries on the right had been silenced with the exception of one gun and an attempt to get their teams up had met with disaster, every team being knocked out before a gun could be got away. The batteries in the valley below were nearly all silent—most of the personnel having been gassed.

About mid-day the enemy's fire slackened somewhat, Lieut. Hamilton was relieved from F.O.O. duty and rejoined the battery, and advantage was taken of the comparative lull to evacuate the wounded—four of whom were killed by shell fire on their way back. Some French walking wounded came through the battery position and reported that the German infantry were about 1000 yards in front and had captured Locre.

Shortly after this it became evident that Kemmel Hill was completely surrounded and was practically in German hands.[1] Dranoutre had been captured and the enemy's infantry had reached

[1] NOTE:—As a matter of fact the French Cavalry actually on the Hill held out till dark.

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the Locre—Bailleul road just at the foot of the eastern slopes of Mont Rouge. The Allied front line was, consequently, now in dead ground to the guns of the 84th Battery on the summit of the hill, and about 1 p.m. orders were received to withdraw the battery. A good view of the whole battlefield was obtainable from the crest just in front of the guns but the very heavy 5·9 barrage with its thick smoke made observation extremely difficult, and decidedly precarious.

When the orders for the withdrawal of the battery arrived the Captain of the battery, Captain E. W. Busk, M.C., who was in charge of the brigade wagon lines for the day, was making his way forward to try and get information as to the general situation; Lieut. Moran, who, as already noted, had been wounded on the previous night, was still in the wagon lines and make a gallant effort to get the teams through by road. The whole route, however, was under very heavy fire and completely blocked by overturned French wagons and dead horses, and after the whole of the horses and drivers of the leading team had been knocked out, the attempt was given up for a time.

About 1.30 p.m. Captain Busk arrived in the gun position bringing the gunners of "F" Sub-section from the wagon line as reinforcements. The battery was now firing at a very slow rate, there being barely 70 rounds a piece left for the two remaining guns. After making himself acquainted with the situation Captain Busk set off to reconnoitre a cross country track with a view, if things got a little quieter, to making another attempt at getting up the teams. The French infantry reserves were now lining the ridge on either side of the battery but the German attack was being held up, and although small enemy detachments got through in rear of the guns these parties soon were cut off, the gaps in our line closed, and the attack definitely stopped in Locre village.

About 5 p.m. the gun limbers with specially picked teams and drivers under Captain Busk and Battery Sergt.-Major Broomfield, D.C.M. crossed the valley below the battery position. The going was very bad, the ground was intersected by small nullahs and ploughed up in every direction by the violence of the German bombardment. As the limbers reached the foot of the steep slope immediately behind the guns they were spotted by three low-flying German planes that had been flying up and down the battery, machine-gunning it. These planes evidently sent a 'zone-call' to their heavy batteries, as a furious and concentrated bombardment was put down on the valley just where the teams had momentarily halted about 30 seconds before.

The teams galloped up the very steep sides of the hill and the four guns that it was possible to move were limbered up. The other two had by now been smashed to pieces. It was impossible to take the guns back by the route the limbers had come up as the hill was too precipitous; both roads leading to the rear were blocked along their length and under such heavy fire that nothing could live on them; the only course open, an audacious one—but audacity in war spells success more often than is sometimes realised—was to go *forward* down the front towards Locre, then make a detour across the front behind the firing line, and so back by Reninghelst—a distance of about 6 miles.

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The moment the teams appeared above the crest they came into full view and a storm of fire burst over them, every German battery within reach turning on to them, and opening with all natures of shell from 8-inch downwards . The very boldness of the manœuvre was however their salvation, for as the teams trotted steadily forward most of this fire fell behind them or to a flank, the opportunity afforded being of too fleeting and unexpected a nature for the precise German gunners to deal with it effectively. The guns reached Canada (formerly Hyde Park) Corner near Locre and swung to the left towards Reninghelst along the road which at this point was parallel to and about 300 yards from the actual firing line. Just near here a large tree had been uprooted by a heavy shell and flung across the road, and was lying on its branches completely blocking the way, forming an obstruction 3-feet high at its lowest point. The guns took this obstacle at a gallop, and owing to the way the horses were handled by the drivers, several of whom were old drivers from India,[1] all the teams cleared the jump without accident.

Once behind the Scherpenberg the column, which had up to now moved in full view of the enemy, got out of sight of the German batteries and machine guns, and made its way back to the wagon lines without further incident, having come through without a single casualtiy to man or horse.

The Battery Commander, after seeing the dead buried and salving all that was possible, led the remnants of the gun detachments back to the wagon lines as soon as dusk had fallen.

By 8 a.m. next morning the battery had four guns in action in a fresh position covering the new front line.

In recognition of the part played by the 84th battery in this action Major Green and Captain Busk were both personally decorated with the Croix de Guerre—the French Divisional Commander coming up to Brigade Headquarters in action in order to do so. Lieuts. Moran and Hamilton received the Military Cross, and Lieut. Howe was mentioned in despatches. Sergt. Tracey was awarded the D.C.M. and 5 other ranks in the gun line the Military Medal.

The Drivers selected four representatives from amongst those who brought the guns out of action and each of these four drivers received the Military Medal. No mention, as yet, has been made of the Battery Signallers but these men did invaluable work all day. All wires were cut to pieces within half an hour of the German bombardment starting and the signallers continually and with unflinching resolution carried messages through most intense shelling to and from brigade headquarters, which was in a quarry at the other end of the hill. One of their number who displayed conspicuous gallantry received one of the Military Medals awarded to the gun line. This particular action, which is only recorded as being typical of those fought by many other batteries on similar occasions during the war, is at any rate representative of all ranks of The Royal Regiment—on this day the gunner, the driver, and the signaller each did their share in maintaining the good name of their battery, and the traditions of the Regiment.

[1] NOTE:—Driver Hutchinson, the wheel driver of the leading team had been in the battery since the end of the South African War.

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CONTENTS OF LEADING FOREIGN JOURNALS.

America.

National Service—November, 1920.

(Extract). The War Department announced the establishment for purposes of administration training and tactical control, of nine corps.

For purposes of inspection on manœuvres, plans for mobilization, war, demobilization, etc., the nine corps will be grouped into 3 Army Areas.

The Commanding Officers and Staffs of Armies will be appointed only when the necessity arises.

This rearrangement of the Army on a tactical basis was effective on September 1st.

France.

Revue d'Artillerie—October, 1920.

I. Organisation of the Artillery in the Army Corps. Gen. Farsac.

The present organisation of Artillery is as follows:—

Per Infantry Division
1 Regt. 75 of 4 groups.
1 Regt. 155 of 2 groups.

Per Army Corps
1 Regt. Heavy Arty. of 4 groups.

Thus in a Corps of 4 Divisions the proportion of Divisional Artillery to Corps Artillery is 6 to 1, or in a Corps of 3 Divisions as 4 to 1. After reinforcement by units of the General Reserve of Artillery the average remains 4 to 1.

From this it is seen that the Corps which is the real "battle unit" and whose duty it is to organise and direct the fire tactics, has ¾ of its Artillery under Divisions, and keeps only ¼ under its direct orders. The writer after discussing the disadvantages of this system proposes that: Divisional Artillery should consist of "The Artillery of Accompaniment" and "The Artillery of Direct Support," i.e., 75's and 105 Hows., and that all the Heavy Artillery should belong to the Corps, under the direct orders of a Brig.-General, Corps C.R.A. He considers that the concentration of the more powerful guns under the direct control of the Corps would enable the Corps Artillery Commander to direct the fire action more efficiently during the whole development of a battle.

The proposed organisation in no way to prevent the temporary allocation of Heavy Artillery to Divisions.

II. Automatic corrections for displacement. Lt. E. Gerard.

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III. Recruitment and employment of military and civil labour. Lt.-Col. Delavallé.

IV. German and Austrian High Power Guns. (Continued.)

V. Miscellaneous News.

Italy. The factories of Ansaldo were producing a long-range gun, just at the time the Armistice with Austria was entered on.

Specification.
Calibre, 20$^{c/m}$.
Length, 100 calibres.
Weight of Shell, 105 kilos.
Muzzle velocity, 1500 m.
Maximum range (50° elevation), 140 kilos.
(From Rivista di Artigleria e Genio. April—May, 1920.)

Revue Militaire Générale—October, 1920.

An episode in the Eastern Campaign—The capture of the village of Florina. Gén. Salle.

The check to the German Offensive on the Ourcq in 1918. (Map.) Col. Boullaire.

Some reflections on the recruiting laws. Col. Defrasse.

Swiss News. Maj. de Valliere.

Belgium.

Bulletin Belge de Sciences Militaires—November, 1920.

I. Strategic Railways of the Belgian Army 1914—1918. (Continued from Sept., 1920). Maj. A. E. M. Denis.

II. The War on Parasites on the Belgian Front. (Concluded.) Drs. de Coster and Sillevaerts.

III. Notes on Armoured Cars. (Continued.) Capt. Comdt. Vander Donckt.

IV. On the rôle of the Officer seen from the War. Cap. Comdt. Menzel.

V. History of Tanks. (Concluded.)

VI. Graphic charts for the solution of fire problems. (Concluded.) Capt. Taymans.

VII. Construction of concrete machine gun posts. Maj. Grenson.

VIII. Bibliography includes reviews of

(1). An article in the "Revue des deux Mondes," Sept. 1, 1920. Nos grands chefs—Le Maréchal Joffre.

(2). Gén. Rouquerol's small book.
"Le canon artisan de la victoire," published by Berger Levrault, Paris.
The book consists of 105 pages and is a series of seven letters to one of his old Artillery Colleagues.

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Switzerland.

Revue Militaire Suisse.

I. Gas warfare.

II. Some notes on the Swiss Air Force during mobilization.

III. Tanks.

IV. Notes and News.

Switzerland. Disbandment of Volunteer Corps formed in 1918 as "Troupes de Surveillance" on grounds of economy, despite protestations in public press of all parts of country. The complete suppression of this Corps has opened the N. Frontier to the crowd of aliens waiting to pass into Switzerland. A bad time to deprive the Frontier of its Garrisons.

The people cannot see why the guard considered indispensible in 1919 should become unnecessary in 1920 For the state of Europe has not improved in this period.

War continues in the East in several theatres. The incessant troubles affecting our neighbours of the N., E. and S. prove that our vigilance should not be relaxed. Undesirables—unemployed soldiers, Communists, revolutionaries, Germans, Slavs and Jews now enter the country without passports.

Economics and state of preparation of Army, etc., etc.

REVIEW.

Principes usuels de Nomographie avec application a divers problèmes concernant l'Artillerie et l'Aviation. By Lt.-Col. d'Ocagne. 67 pages. Paris (Gauthier—Villars) 1920.

This pamphlet is Lt.-Col. d'Ocagne's latest published contribution to the subject of Nomography, and is of particular interest to the artillerist, as it is directly concerned with the construction of nomograms utilized in ballistics and gunnery.

The exposition of the theory is substantially a condensed version of that given in his "Calcul Graphique et Nomographie" published in 1908.

Some of the simpler examples are already familiar, but the more complicated ones are novel and elegant illustrations of what can be done by his methods in different cases.

It is a pamphlet which should be studied by all those interested in the application of graphic methods as an aid to calculation in ballistic and gunnery problems.

11.11.20. R. K. H.

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GIFTS AND PURCHASES DURING THE MONTH OF OCTOBER, 1920.

Books Presented.

By The Secretary, War Office.

Handbook of the B.L. 8-inch Howitzers, Marks VI to VIII, on travelling Carriages. 1920.

Gun Drill for 13-pr. Q.F. Gun, Marks I and II. Carriage Mark I. 1920.

By The Publishers.

Ribbons and Medals. Naval, Military and Civil. Ill. 3 parts in 1 Vol. By Commander H. Taprell Dorling, R.N., London (George Philip & Son). 1920.

Principes usuels de Nomographie avec application a divers problèmes concernant l'Artillerie et l'Aviation. Par le Lieut.-Col. d'Ocagne. Paris (Gauthier-Villars et Cie.) 1920.

By Capt. W. Mair, R.G.A.

Schiessvorschrift für die Artillerie. Vom. I. December, 1917.

Books Purchased.

Naval and Military Despatches relating to Operations in the War:—
Part VIII—July, 1917 to June, 1918.
,, IX—July, 1918 to December, 1918.
,, X—January, 1919 to January, 1920.

A History of the British Army, Vols. IX and X, with separate Volume of Maps. By The Hon. J. W. Fortescue. London (MacMillan) 1920.

Letters to Young Sportsmen on Hunting, Angling and Shooting. By Lt.-Col. J. MacKillop, H. G. Hutchinson, and The Hon. Douglas Cairns. Ill. London (Country Life) 1920.

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The Journal of the Royal Artillery.
January, 1921.

The Past History of the World Revolution. A Lecture delivered at the Royal Artillery Institution, Woolwich, on Tuesday, 30th November, 1920. By Mrs. Arthur Webster. Col. Sir H. D. White-Thomson, K.B.E., C.B., C.M.G., D.S.O., R.A., in the Chair. 457

Surprise, Rapidity, Concentration. By Lieut.-Col. H. Rowan-Robinson, C.M.G., D.S.O., R.G.A. 473

Gambling and Groups. (Being a sequel to Betting and Brackets). By Captain D. R. D. Fisher, D.S.O., R.F.A. 481

A History of Artillery. Part IV (continued from page 448). 1783 to 1815: Quo fas et Gloria Ducunt. By Ralph Flenley. (Conclusion). 491

Tempora Mutantur. A reply to Captain Hilton's article under the above heading in the R.A. Journal for October, 1920. By Capt. J. H. M. Stevenson, M.C., R.G.A. 504

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Any lettering should be written in pencil, that it may be re-drawn to the proper scale.

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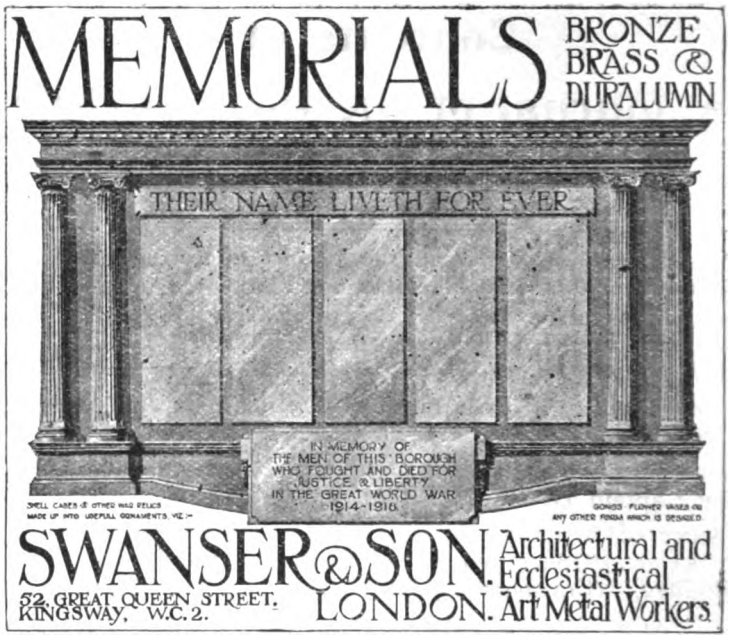

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THE PAST HISTORY OF THE WORLD REVOLUTION.

A Lecture delivered at the Royal Artillery Institution, Woolwich, on Tuesday, 30th November, 1920.

By Mrs. Arthur Webster.

Col. Sir H. D. White-Thomson, K.B.E., C.B., C.M.G., D.S.O., R.A., in the Chair.

CHAIRMAN: Lord Horne, Ladies and Gentlemen, I have great pleasure in introducing to you Mrs. Arthur Webster who is going to talk to us about the origin of the World Revolutionary spirit which is going on up to this day. Mrs. Webster is known to a good many of us as the author of sundry books including one which to my mind is the most important, namely "The French Revolution." To this last work she applied several years of very strenuous work and during that time had access to originals of contemporary writers on all sides of the question, not only one side but Revolutionaries, Royalists and Orleanists, finding these authorities in the British Museum and elsewhere.

In the course of her studies she hit upon the fact that the Revolutionary spirit was not that represented by Carlyle, whose history we were all brought up upon—as the spontaneous rising of the down-trodden peasantry against the aristocrats—but on the contrary that it was a real conspiracy of world revolution. This conspiracy Mrs. Webster will trace for you absolutely unaltered in its tenets from back in 1776 to the present day. It has been found that in all revolutionary movements the first aim of the conspirators is to get at the fighting forces of the Crown or Republic, whichever is being aimed at; and, therefore, it is very important for us as soldiers to have our eyes opened to the views which the Revolutionaries are circulating, which may be produced among our soldiers, and indeed may already have been mooted in barracks and elsewhere. It is our duty as Officers and Non-Commissioned Officers to learn all these things so as to be able, if possible, to counter them when they arise and so safeguard the allegiance of the troops for whose discipline we are responsible against all seditious propaganda.

I will now ask Mrs. Webster to start her lecture if she will be good enough. (Applause).

MRS. WEBSTER: I feel it is a great honour to be asked to speak to so many soldiers of the Crown, who have helped to save our Country in its time of need, and I am sure that it must be a matter of profound regret to all the men who fought for England to feel that now that peace is declared officially abroad, we are threatened with dissensions at home.

As Sir Hugh White-Thomson has pointed out, my particular object in coming before you this afternoon is to describe the origins

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of the conspiracy which I believe to be at work amongst us—that age old conspiracy that began at least 150 years ago and of which the French Revolution of 1789 was the first manifestation. Now, in order to bring before your eyes the forces at work at that date we have had this chart constructed which you will notice is printed in two colours,* black and red—red for the open revolutionary forces, black for the secret hidden forces in the background pulling the strings.

Before the first French Revolution you will see here the two red forces, firstly philosophy, open and subversive doctrines disseminated by such theorists as Rousseau and Voltaire, and secondly, German Imperialism, headed by Frederick the Great whose plan was to break the Franco-Austrian Alliance which impeded the way of Prussia to power. This struggle for power has been the policy of Prussia from that day to this. Then there are the black forces of the secret societies, the Martinistes founded by Martinez Paschalis, and the lodges of Grand Orient Freemasonry. The latter order must not be confounded with the Craft Masonry of Britain which is in no way revolutionary, but in France Masonry had become corrupted, and throughout the 18th Century the Lodges had been centres of political intrigue. It was Freemasonry that first devised the formula which was current throughout the whole French Revolution "Liberty and Equality"—a formula which sounds very peaceful but, when you think it out, is seen to be full of possibilities for discord. Think of those two words Liberty and Equality and observe where the catch comes in. You cannot have complete liberty *and* equality. You can have a system of complete liberty where every man is free to behave as he pleases, to do what he will with his own, to rob or to murder, which is the law of the jungle, the law of the strongest, but there is no equality there. Or you can have a system of absolute equality such as we see being attempted to-day in Russia—everyone cut down to the same dead level, but there is no liberty there. So, Grand Orient Freemasonry by coupling together two words for ever incompatible threw into the arena an apple of discord over which the world has never ceased to quarrel from that day to this, and which has throughout divided the revolutionary forces into two opposing camps.

THE ILLUMINATI.

But of the secret forces the most subversive was Illuminism, the Illuminism of Bavaria founded by Dr. Adam Weishaupt described by Louis Blanc as the profoundest conspirator who has ever existed. It was Weishaupt who thought out the great scheme of world revolution that we see being carried out before us to-day. For five years Weishaupt thought out his plan, which was *to destroy civilisation.* "Civilisation," Weishaupt held with Rousseau was all a mistake. Man should return to a state of pure nature, he must learn to be self-governing, Monarchy and all ordered Government should be swept away; private property should be abolished and inheritance likewise; patriotism, he declared "is an antiquated prejudice incompatible with universal benevolence" and that too should be done away with; marriage and all morality also should be destroyed and, above all, every form of religion.

* NOTE.—The chart reproduced in the Journal is only in one colour. Thick black for the secret forces—italics and thin black lines for the open revolutionary forces.

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Weishaupt was clever enough to see that he would not induce many people to join the Order if he admitted them to the whole secret and, therefore, people were told only half or part of his plan. Christians were told that Jesus of Nazareth was the Grand Master of the Order and only when they were initiated into the higher grades it was admitted to them that the Order was to destroy all religion whatever. The method of Weishaupt was, by gaining adherents in all classes from Kings and Princes downwards, to get everybody to help him to co-operate in his great scheme of "a universal revolution that should deal the death blow to society."

Now, such a project, as far as we know, was unprecedented in the history of the world. Whether Weishaupt was inspired by anyone else we cannot tell; we only know that such a scheme had never been discovered before that date of 1776. Moreover in Illuminism it is impossible to see a system of social reform, throughout the writings of Weishaupt that can be read in the original German, we find no sympathy expressed with the poor or the suffering—nothing but the desire for *world power*, for domination, and the spirit of intrigue. Before long, Weishaupt realized that Freemasonry would act as an admirable mask to his design, and about 1781 he effected an Alliance with the Grand Orient of France. In the following year 1782, a huge Congress of the Secret Societies took place at Wilhelmsbad and there Weishaupt put his great plan of World Revolution before them all. Soon after this the Government of Bavaria discovered the plot and Illuminism was put down in Bavaria but in Bavaria alone. Already it had spread to France. Mirabeau and Talleyrand inaugurated a Lodge of the Illuminati in Paris and the Grand Orient of France then accepted the Code of Weishaupt. By the Spring of 1789, 266 Lodges of the Grand Orient had been illuminised, and then the Revolution could break out.

THE FIRST FRENCH REVOLUTION.

We cannot fail to detect in the earlier outbreaks of the French Revolution a mysterious masonic organisation, famine engineered, grievances amongst the people created and exploited; but the revolutionaries were quick to see that they could bring about no real disorder as long as the troops stood firm. Thus, at the first outbreak (an attack directed against the house of a paper-maker who had established a factory where several hundred workmen were employed and well paid) the troops protected the building. The revolutionaries then realised that nothing could be done unless they could seduce the troops and every effort was made during the months which followed to gain the troops over to the side of the revolution. This was done by means of wine, good cheer and the women who frequented the part of the town, the Palais Royal, where the soldiers collected, and who were primed with revolutionary doctrines which they whispered into the soldiers' ears. The soldiers were also persuaded to enter the Masonic Lodges where they were urged not to fire on their brothers in time of need. Who were those "brothers"? Mainly foreign agitators employed by the revolutionaries, Italians, brigands of all kinds enticed into Paris and paid by them. Those were the "brothers" the soldiers were asked not to fire upon.

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The revolutionaries were successful in winning over a number of the troops, and the result was the fearful disorder which accompanied the siege of the Bastille. During the next three years rival intrigues held up the plan of the Illuminati, and it was not until 1792 that the great world revolution of Weishaupt began in earnest. Then with the fall of the Monarchy each point in the programme of Weishaupt was carried out in turn, the murder of the King, attacks upon all morality, attacks upon civilisation in every form, the burning of the libraries and the destruction of works of art all over France,—above all the de-Christianising of France carried out by the desecration of the churches, the stamping on the crucifix and the casting of the Bible into the flames.

Now who was the leader of this movement? A Prussian Baron Anacharsis Clootz, a disciple of Weishaupt, the founder of the Illuminati, and incidentally it was Anacharsis Clootz who was employed to preach the old doctrine of Weishaupt—*Internationalism*. What did Internationalism mean? It meant then what it has meant ever since—pro-Germanism; and when Anacharsis Clootz came forward and proposed that as soon as the French Army met the Germans they should "throw down their arms and advance towards them dancing in a friendly manner", Robespierre, who distrusted foreigners, thought it was time to cut short the career of Anacharsis Clootz and finally had him guillotined (Laughter). Robespierre himself was up to a certain point an Illuminatus but he was also, in an embryonic way, a Socialist. Robespierre aimed at equality, and his animosity was particularly directed against the Bourgeoisie and the Intelligentsia. It is a great mistake to think, as many people do to-day, that the French Revolution was only directed against the Aristocrats, while in Russia it is directed against the Bourgeoisie. The last stage of the French Revolution, that is to say the Reign of Terror, was directed every bit as much against the Bourgeoisie and the Intellectuals as against the Aristocracy. It was war on civilisation. Robespierre entered whole-heartedly into this scheme, and the Reign of Terror was the logical outcome of his philosophy as well as of Illuminism for the plan was to ruin all the leisured classes and the prosperous Bourgeoisie including the manufacturers. What was the result? That the entire industrial system was thrown out of gear, that the Republic had on their hands thousands of workers in the luxury trades—as for example the silk weavers of Lyons—with no means of employing them. Paris was filled with bands of unemployed—hairdressers, valets, engravers, bookbinders—all the men and women who had ministered to the needs of the leisured classes, and for which they could not find employment. This situation must always arise if you suddenly dislocate the industry of any country, because all classes are inter-dependent. The Republic was then faced with the fearful problem of providing for all these people. What did they do? They decided, as we know in the words of Babeuf (the Communist), that as there was not enough "work of essential utility to go round", they must kill off that portion of the population for which they could not provide, and they calculated for this reason that the population of France must be reduced from 25,000,000 to 8,000,000 of people.

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The Reign of Terror then was not directed only against the aristocracy and bourgeiosie but also mainly against the unemployed. In the records of the period I find it stated by a Revolutionary writer, (Prudhomme) that during the period of the Terror 2,000,000 people perished both by foreign and civil war; that out of this number 300,000 were actually killed—guillotined, drowned, or shot,—and that out of those 300,000 about 3,000 were aristocrats, the rest being middle and working class people. 500 children were killed in one butchery and 144 little seamstresses who sewed shirts for the army were thrown into the river at Nantes. Fortunately the revolutionaries were unable to carry out their plan to the end, and Robespierre himself was guillotined.

THE CONSPIRACY OF BABEUF.

But, after the fall of Robespierre, a disciple was found to carry on his Socialistic doctrines and this was Babeuf. Now Babeuf was an Illuminatus and it was he who first formulated the creed of Communism as it is known to-day. Babeuf was a pure Bolshevik, and if you read the book by his colleague Buonarotti, who helped him to bring about the "Babouviste rising", you will find no difference whatever between the system planned by Babeuf and the one advocated by Lenin to-day. This consisted simply, in taking all property and placing it in the hands of the Government, which would employ everybody by means of forced labour to work for the State in return for a dole of food and clothing. Babeuf succeeded in getting a certain number of the troops to side with him, but he was careful not to tell them what his real plan was. "We thought it better", said Buonarotti, "to try to tempt the greed of the people by telling them they would have everything for their own property." They did not tell them that everything would be placed in the hands of the State, and, when Babeuf was arrested by the Government, the people saw they had been deceived and were the first to applaud his arrest and his condemnation to the guillotine.

The idea of *world revolution* continued all through this period, for it was Babeuf who said these words which sound so terribly prophetic to-day: "The French Revolution is only the forerunner of another Revolution very much greater, very much more solemn, and which will be the last". This idea seems to have haunted the imagination of every world revolutionary from that day to this, the idea of the great cataclysm and the final extinction of civilisation. Meanwhile Illuminism had not confined itself to France; it had spread to England and was carried over to Ireland where the United Irishmen under Wolfe Tone constructed a Society identically on the lines of that founded by Weishaupt. But when Napoleon came into power he suppressed Illuminism, and for 15 years Europe, distracted by International warfare, had peace from the fire of Illuminism.

THE INDUSTRIAL REVOLUTION.

The early part of the century that followed was marked by the Industrial Revolution. The grievances of the people were no longer mainly agricultural as in France before the French Revolution but largely industrial. There had been a great speeding up of industry owing to the destruction of feudalism and also to the introduction of

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machinery, so that most of the schemes we find formulated at this period deal with the difficulties between capital and labour. It was thus that this little group of theorists arose, called for the first time "Socialists" in about 1836. St. Simon, Fourier, Leroux, Blanqui, Buchez, Louis Blanc, and in England a little earlier Robert Owen, who is known as "the father of British Socialism." The aim of all these men was to found some system which would supersede what is known as the capitalist system, and several tried some scheme of his own—the Phalanx, or the Triad, or the Communist Settlement, or the Working Men's Association—every conceivable plan put before us to-day was tried in the first half of the 19th Century, and *every one failed*. The only new scheme which answered was *co-operation* which was instituted in England by the Rochdale Weavers, who started a co-operative Society, but it was not Communistic because it did not deny the right to private property, and for that reason co-operation succeeded and has been going on from that day to this. Personally I believe that social progress consists in co-operation, not in communism. (Applause).

At the same time we find the revolutionary idea developing in a different way along the line of anarchy exampled by Proudhon. The Communists or State Socialists aim principally at *equality*. The Anarchists aim at *liberty*. We see now the rift between the two parties. The creed of anarchy is that there should be no State at all, while the Socialists say the State should be supreme, that everything, as we say to-day, should be nationalised. The Anarchists say "No, no State control at all, absolute liberty, no Government." It must not be supposed that the word Anarchist is used here as a term of opprobrium; it was a word applied by the Anarchists to themselves; they said: "We are Anarchists; we wish for no laws and no Government." The feud between these two revolutionary camps is even greater than the feud between them and the existing system, for, if you come to think it out, each is opposed to the other far more than either is opposed to our system of Constitutional Government. The people who say "Everything should be ruled by the State", are obviously directly opposed to the people who say "No State at all". Our system is the happy mean between the two. We say that a man has a right to his own wife, his children and his home, as long as he does his duty by them; the State only intervenes if he neglects them. Therefore it will be seen how admirably our system meets a certain degree of liberty and a certain degree of equality since you cannot have them both, and it is for this reason that there has always been this fierce antagonism between the two camps of the Anarchists and the Communists. Proudhon loathed the Communists! "Far from me, Communists! "he cried", your presence stinks in my nostrils", and later we find Karl Marx animated by the same fierce hatred of Proudhon.

But it was neither the Communists nor the Anarchists who provided the great driving force behind the revolutionary movement,—it was the secret forces behind them, the continuation of Illuminism which appeared again in the Tugend Bund, in the Polish Secret Societies at the time of the 1825 rising in Russia, in the Carbonari, and finally in the Haute Vente Romaine, the Secret Society directed

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specially against religion, and conducted identically on the lines of the Illuminati. The plan of the Haute Vente Romaine was universal corruption and the destruction of the Christian idea throughout Europe.

We find, if we read their writings, that even the Socialists themselves are conscious at this period of some mysterious force at work. Extraordinary things happened at that time which nobody could explain. The Trade Union movement in England, which had originated with the mere idea of benefitting all the workers, displayed a terrible ferocity; men were not merely boycotted for disobeying the orders of their leaders but were threatened, murdered, their houses were burned down and their wives and children turned out of doors. We find men who lived at that time saying "What is the mysterious tribunal behind which orders these crimes?", and everywhere the same feeling was abroad, that there was something directing, some secret power that even the Socialists themselves could not understand. These then were the forces which brought about the Revolution of 1848, the second attempt to realise the world revolution of Weishaupt.

THE REVOLUTION OF 1848.

The demands of the people at this date were perfectly reasonable; they asked only for shorter hours of labour, for better pay and not to be exploited by the middleman, but above all for the solution of the problem of unemployment. Now there is no more burning question than the problem of unemployment; there is no question towards which we should display greater sympathy, and the man who devises some plan by which unemployment shall be made impossible, will be the greatest benefactor of the human race who has ever lived. Unhappily the Socialists who had formulated all kinds of theories for counteracting unemployment found themselves helpless when brought face to face with the crowd who invaded the Luxembourg when the Revolution broke out. They had promised them *the right to work*, the formula you see to-day painted on the banners of the unemployed, but when the workmen stood before them, when they were confronted by the angry mob saying "Give us this right to work you promised us", they could not give it because no Government can create employment. The only way by which employment can be provided is by the increase, not by the decrease, of civilisation, by multiplying needs not by reducing the standard of living. The Revolutionary movement, therefore, aiming at the destruction of civilisation, was going the very way to work to make things worse than they had been before. The cause of the workers was lost in 1848 through the conduct of the agitators who drove them from the path of social reform into violence which necessitated repression, and 10,000 working men fell in the conflicts which took place on the barricades of June. The people were not primarily to blame; it was the agitators who put them in the wrong, who "queered their pitch" all along the line and alarmed the country by their incitement to violence, and by the aggressive attitude they persuaded the workers to assume.

By 1848 it was shewn that Socialism, as it had been attempted, was an unworkable system. The National Workshops and the

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Working Men's Associations started by the Socialists had failed. Why had they failed? Because the workers had no incentive to work on equality of pay, because there was no competition; and the Communists Settlements attempted by Cabet and Robert Owen had failed for the same reason, because they left human nature entirely out of the question. You cannot get people to work with any enthusiasm if you deny the right to private property, and so by 1848 Socialism, "Utopian Socialism", as Marx called it, died a natural death.

GERMAN SOCIAL DEMOCRACY.

It was then that a change came over the movement and the new phase began in which we are living to-day. Socialism, a derelict concern, was now taken over by a Company. That Company was the German Jewish band of "Social Democrats." Here we see the inauguration of the *régime* under which Russia is living to-day. It was begun by two Jews, Karl Marx and Lassalle, and the German Engels. Now in no country had the Jews been so despised as in Germany; and nowhere had they appeared so great a danger to the State. In 1848 when the revolution started in Germany the Jews and Freemasons of Germany took a very large part in the disorders, and Prussia was clever enough to realise that the best thing she could do was not to oppress the Jews any longer but to get them to work for her and to employ them as a great subversive force in the German Imperial machine. It is evident that at that date some pact was formed between German Imperialism and the Jews of Germany. The man who was mainly instrumental in inaugurating German-Jewish Socialism was Karl Marx, a Jew born at Treves whose original name was Mordecai. Marx had been exiled from Germany for belonging to a Secret Society but Prussia realised the use that might be made of him to spread sedition in those countries which she wished to destroy. Marx had constructed the system which is known to-day as Marxian Socialism, and it is of the utmost importance for everyone to understand to-day what this system is and how it originated for it is on this that Bolshevism is founded. *Bolshevism is simply Marxism.* Marx is the deity presiding over the ruins of Russia. Now to begin with Marx originated nothing. He found everything that his system contains in the British Museum. His Communism was that of Babeuf, his theory of wage slavery was current during the French Revolution, his idea of the class war had originated with Weishaupt, his theory that labour produces all wealth had been formulated by Robert Owen and the Chartists, his theory of surplus value had also been proclaimed by the Chartists. Marx thought out nothing; he simply welded all these things together into one subversive whole. Marx's system which will be found contained in his Communist Manifesto published in 1847, strangely enough contains all the points of Weishaupt, the abolition of property, the abolition of inheritance, the abolition of marriage, the abolition of all morality, the abolition of patriotism and the abolition of religion.

Meanwhile Illuminism had continued along the line of anarchy and here we find the Russian Bakunin founding a Society on the identical lines of the Illuminati, and again formulating as a creed the six points of Weishaupt. Can it be a mere coincidence that those

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two men, the one a Communist and the other an Anarchist, should have brought forward the original plan of the Illuminati for the destruction of civilisation? Bakunin differed from Marx in his attitude towards religion in this way, that whilst Marx was a cold materialist, Bakunin was a Satanist. Bakunin worshipped Satan. His favourite toast was "I drink to the destruction of all law and order and the unchaining of all evil passions". We find this extraordinary vein of Satanism running all through the Anarchist movement, and in order to bring about revolution Bakunin declared "We must increase and multiply the evils and the sorrows of the people in order to drive them to insurrection *en masse*." This was the diabolical creed of the Anarchists. But beyond the society of "The Social Democratic Alliance" founded by Bakunin on the lines of Weishaupt, there was a further secret society of which I cannot tell you the name. Bakunin found out its existence through his disciple Netchaïeff and that it was led by about eight men who alone knew the whole secret.

THE INTERNATIONALE.

Meanwhile the working men of Europe had begun to realise that if they were to depend upon the agitators they would never achieve any reforms, and it was therefore they who started the association known as the "Internationale"—the "First Internationale",—that is to say the "International Association of Working Men." There was nothing revolutionary in the idea of the Internationale; the idea of the workers was to join hands with their fellow workers all over the world and demand better conditions of labour. It was not until Marx and Bakunin contrived to get into the movement that they turned it from its original purpose. Marx betrayed the workers for though it was he who had laid down as the fundamental principle of the Internationale that the working men should depend upon themselves for their emancipation, when the working men said "We want to keep our Association to ourselves, we do not want all these middle-class theorists joining in", Marx derided them and said that this was "a manœuvre" which must be outwitted. Before long he contrived to get himself and his German and Jewish friends into the Association; the French working men he described as "the Parisian chatterboxes," and referred scathingly to "the English swinehounds amongst the Trade Unionists." These words can be seen in Marx's correspondence published by a Socialist Publisher.

The Internationale therefore through Marx and Bakunin, absorbed the ideas of Illuminism, and likewise those of the other Secret Societies then existing in Europe, As a Working Man's Association it became a farce. Marx used the Internationale in the interests of pan-Germanism. I have here a pamphlet written by a Socialist, the interpreter to the Second Internationale in which he describes in detail all the manœuvres of Marx in the cause of Germany; he shows how he worked for Bismarck, how he tried to paralyse the resistance of the French towards Prussia before 1870, how he admits that he has been accused of receiving £10,000 from Bismarck and does not deny it. The Internationale was forbidden in Germany. Germany would have none of these Associations which

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were likely to weaken the patriotism of her own working men but she favoured the cause of the Internationale abroad, and so it came to pass that when in 1870 revolution broke out in Paris the troops were once more corrupted and the result was the terrible era of the Commune which for two months lived in murder and pillage and burning. It was the third attempt to bring about the world revolution of Weishaupt and 20,000 men and women of the people fell in the conflict. Anarchy which had ruled in Paris then spread to Russia and to Ireland where the Irish Republican Brotherhood was formed on the lines of the Illuminati.

SYNDICALISM.

It is at this stage that anarchy assumes a new form, *Syndicalism*. Syndicalism of which we hear so much to-day, was the outcome of anarchy. Its ruling theory is that when property and government have been taken out of the hands in which it is to-day, it shall not be placed in the hands of the State as the Communists suggest, but in the hands of different groups of workers—that the miners should own the mines and the railwaymen the railways. This principle had first been put forward by Proudhon who was described as "the father of anarchy". "Each industry" said Proudhon "should be as the hive is to the bees—the property of the workers". It is definitely anti-State and must lead to anarchy for, if successful, consider what Syndicalism would mean. It would mean the absolute tyranny of the key industries of the country; no one would have any rights but the workers in those industries on which we are dependent for the essentials of life. The whole country would be ruled by the miners, by the food providers, by the transport workers and such like or rather by their leaders. The rest of the population would have no rights or liberties whatever. They could be perpetually starved out of existence by the key industries. The result must be anarchy for there would be no State to act as umpire and to say when the coal-miners were charging too much for the coal or the railwaymen too much for freight. Without a State you could not maintain any fairness or justice in industry. But to the Syndicalist the political system is not the point; the point is to bring about the day of revolution. If you read Syndicalist literature, you will find they deal very little with their plan for the re-construction of industry; all they speak of is the great day of what they call *expropriation* when the people shall be made to rise and seize everything by means of the *general strike*.

The idea of the general strike was first proposed in 1868 at a Congress of the Interationale at Brussels and became the policy of the C.G.T.—the General Confederation of Labour in France—and ever since that date attempts have been made to bring off this fearful cataclysm of which its principal advocate Georges Sorel, the leader of the French Syndicalists, declared: "The passage from capitalism to socialism will be a catastrophe of which the details defy description", indeed he goes so far as to say "We must not look beyond it"; all that Sorel and the leading Syndicalists demand is this awful day of destruction.

Therefore when Mr. Lloyd George declared during the railway strike last year that they had evidence of an anarchist conspiracy,

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he was historically accurate because *the general strike is the weapon of syndicalism* and syndicalism is the outcome of anarchy. Nothing could come of a general strike—that is to say all industries striking at once—but absolute chaos from which the Nation would perhaps never recover. The workers all over the country should be told that the idea of the general strike is not the outcome of any present emergency but an old plot formed 52 years ago (largely by a French anarchist carpenter called Tortelier) in which our enlightened working men are asked to co-operate. Syndicalism is not Socialism and it is not Bolshevism. Bolshevism does not advocate the general strike although it is willing to make use of it. But Syndicalism and Socialism, although as violently opposed to each other as anarchy and Communism were earlier in the century, are willing to work together in one cause and that is the cause of Internationalism, of anti-patriotism which has always served the cause of pan-Germanism. Syndicalists and Communists alike helped Germany before the War and helped Germany throughout the War. The troops in Russia were seduced by Socialism and by these means Russia was put out of the War.

THE RUSSIAN REVOLUTION.

The Russian Revolution was not the result of the Russian Revolutionary movement which had been mainly anarchic, conducted by the group including Bakunin and Netchaïeff and the Nihilists, later by Kropotkine, and which still exists in Russia to-day. Terrible as were their methods, these fanatics were really Russian, and the first thing the Bolsheviks did when their day arrived was to turn their machine guns on to the Anarchists and blow them up to Heaven. The Social Revolutionaries were also Russian in their sympathies representing the peasants rather than the industrial workers of Russia, and as Lenin and Trotsky themselves admit they were the most powerful party during the first stages of the Bolshevik Revolution. Trotsky boasts of the way the Bolsheviks managed to establish their domination over the great majority of the Social Revolutionaries and the Mensheviks. Now the Bolsheviks were the outcome of two factions that existed from 1905 onwards—the Russian Social Democratic Party, followers of Karl Marx and the Jewish Bund. Bolshevism in Russia, is therefore German and Jewish. This is bringing no accusation against the Jewish race; it is merely stating a fact, for just as Anarchy is Russian, just as Syndicalism is French in its origin, so Bolshevism is German-Jewish in its origin. The Marxian faction was described by Bakunin in his day as "the German-Jew Company," or "the Red Bureaucracy" and nothing could better describe the faction which is now ruling Russia. Bolshevism, therefore, is largely Jewish and we cannot wonder that to many people the whole world revolution seems to be a Jewish conspiracy. I have heard our officers returning home from Russia saying "I am convinced that the whole of this movement is a Jewish plot to destroy Christianity" and in all countries we see Jews playing a leading part, in our own country we see them inciting to violence, we see them as interrupters at patriotic meetings and filling the Albert Hall at the Red Flag Meetings. But, personally, I do not think that we

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can call it entirely a Jewish conspiracy for it is also largely German. I have shown how in its origin Internationalism was German. One can follow the whole plot from the German Weishaupt, through the German Clootz and through German Social Democracy encouraged by Bismarck, financed by German Imperialism. Nor must we forget that it was the German General Staff that sent Lenin and his colleagues to Russia in a sealed train and that the Germans have helped the Bolshevist Government. German Officers had led the armies of the Bolshevists against General Wrangel and I do not doubt that the whole movement to-day is being worked by the continuation of the German Secret Society of the Illuminati which we know was reorganised in 1880. Illuminism is not a dead and gone thing, it is an actual living force in the world to-day and I believe it is this Sect which is ruling Russia and that Lenin may be merely the agent of this mysterious power. Lenin has been described as an idealist. I do not ask anyone to believe what is said of Lenin by travellers who have returned from Russia and are more or less prejudiced one way or the other. I ask everyone who would know what Lenin is to study his own writings, and I will defy anybody, after reading them to describe Lenin as an idealist. What are the ideals of Bolshevism? I have here several Bolshevist pamphlets and you can see for yourselves what the ideals of Bolshevism are as expressed by the Bolsheviks themselves. Here is "The Russian Code of Labour Laws" for example, published by authority of The Russian Information Bureau (a Socialist organisation) which tells us of compulsory labour for men and women alike for eight hours a day which I am told are now raised to 12. Then here is "The Programme of the World Revolution" by Bucharin the friend of Lenin, which tells us that private property is to be abolished, that the whole country is to be turned into "one vast labour Commune" where in return for forced labour of so many hours a day each man and woman may receive their dole of food and clothing. It tells us also of the necessity for the destruction of religion, for religion, it tells us, is opium to the people. Or we can read this pamphlet by a friend of Lenin, Madame Kolontay which tells us of the necessity of breaking up the family entirely, that a man shall no longer own his wife or his children and that every woman shall work for the State so many hours a day. It is simply the work-house system—a plan to turn the whole country into a gigantic work-house from which there can be no escape. Where the "ideals" of Bolshevism are to be found in all this, personally I fail to see; all that they can lead to is the fundamental idea of Illuminism—the destruction of civilisation and this is indeed the belief of the Bolsheviks. "Everywhere I went in Russia", said the Rev. Courtier-Forster on his return from that unhappy country," the Bolsheviks told me that civilisation was all wrong and must be done away with, and Mr. Lansbury returning from his visit to Lenin observed in the "Daily Herald" on the 30th June "We believe that man has been on the wrong road ever since the dawn of that thing we call civilisation". Therefore the avowed aim of the Bolsheviks is to destroy civilisation. This is the plot which has continued since 1776 onwards and which is now at work in England. It is *an alien conspiracy*. The leaders in this country

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are indoctrinated by subtler Continental brains. You will notice that nearly all the advocates of Bolshevism in this country to whatever class they belong were on the side of the Germans during the War; they were all for pacifism and for letting down Germany gently but now they are out for bloody warfare against their fellow countrymen. I cannot doubt that these men are dupes, indeed the extraordinary ignorance that they display in their speeches and writings shows they have no idea of the issues at stake. The same extremist type of leader will talk in one breath of nationalising the railways or the mines and in the next breath of giving the mines to the miners, the two policies being absolutely opposed to each other. They do not know whether they are Syndicalists or whether they are Socialists or Communists or what. All they do know is that they want revolution. Why do they want revolution? Because they are being pushed from behind. They are being prompted. England is the objective against which the revolution is now being directed. Why? Because England is the greatest stronghold of Christian Civilisation. I have been all over the world, in every continent, I have lived for many years abroad, and I say that there is no country in the world which has so high a moral standard as our own, there is no country where the weak and the helpless are so cared for, there is no country where men have so high a sense of honour and integrity or where this sense of honour and integrity permeates throughout every class to the degree that it does in England. Therefore England is the objective of that conspiracy which would overthrow Christian civilisation. As long ago as 1870 Marx sent this message from London "England is the only country in which a socialist revolution can be made. The English are incapable of making that revolution, therefore, foreigners must make it for them. The point to strike at first is Ireland and in Ireland they are ready to begin their work". That is exactly what we see happening before us to-day. The movement which is going on in Ireland did not originate with Sinn Fein. Sinn Fein is in its origin a National and a more or less Religious movement, but it is the International Communist movement, the movement working behind Sinn Fein, which is causing the violence we hear of to-day. That movement if it achieves its purpose will destroy Sinn Fein with all its national and religious aspirations. The art of the conspiracy is to use everyone and everything for its purpose, to work on the mind of everyone who has a grievance; all discontent is grist to the mill of the revolutionaries. They care not what they promise; they will promise you anything; they promise all classes everything they like but they have no intention of giving it to them. Thus during the Police strike 18 months ago they promised the Police improvement of pay and conditions whereas we have it in Lenin's own pamphlets that under Bolshevism the Police are to be disbanded and done away with altogether. Everyone would suffer under Bolshevism, everyone must suffer in time of revolution for when once the springs of law and order are broken no one's life is safe. A King is in no more danger than a crossing sweeper. What we are confronted with to-day is not a class war; it is an anti-patriotic, anti-moral, anti-religious movement. It is a diabolical movement; it is a movement to stamp on everything that is decent, everything that is noble. I was at the Meeting the other day where the Miners' Wives protested against the

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coal strike and I could not have believed that people could have behaved in such a way as the alien interrupters in the gallery who howled down those brave and eloquent working women who had come to London to speak their mind. And what was the thing which roused the wildest howls amongst those aliens? Because one of the women speakers attempted to repeat some verses from a soldier's grave! Those words were met with howls of fury from the gallery. They could not bear anything fine and noble and patriotic. This is not the voice of British labour, I said to myself that evening, these are the voices of the pit. The working men do not want their homes broken up; they want to call their wives and their children their own; they do not want religion stamped on and all decency of thought and life destroyed. It is our duty to tell them the truth. Let us put before them everywhere what this revolutionary movement has brought them up to the present. Look at this chart and see what it has done. It has brought them four terrible revolutions, the first in France with a loss of 2,000,000 lives, the second in 1848, 10,000 lives; in 1871 between 20,000 and 30,000 lives and to-day there is this fearful revolution in Russia which it is said has caused the death of 30,000,000 of the Russian people.

What then has this movement brought to the workers? Has it brought them any reforms? Revolutionaries will tell you "Yes, it has speeded the cause of reform". That is absolutely untrue. Each one of these outbreaks has been followed not by reforms but by a period of re-action, a period that lasted for 20 years after the first French Revolution, for ten years after the second and that has thrown back the cause of reform all along the line. Meanwhile in spite of such set-backs real social reform has gone forward, and I should have liked to have another chart with me to-day to show all that has been done for progress and the workers during the same period by constitutional government—prison reforms, Mines Acts, Factory Acts, Acts as to the employment of children in Factories—every conceivable reform which has been passed during the last hundred years. That is what Constitutional Government has done for England. The people can choose between the two courses which they will take—the revolutionary movement or the path of social reform. I say that we must put an end to revolution and get on with the reforms. This torment must cease. We cannot go on eternally fighting and struggling, tossed on the waves of unrest and I think it depends upon our country more than any other to arrest the revolutionary movement. Marx once said, "England is the rock against which revolutionary waves are broken", and they will always beat in vain if we stand firm. The fate not only of the country but of the world is very largely in the hands of the soldiers of Great Britain. Every revolution depends upon the army, not simply for purposes of repression but because the revolutionaries, if they know that the Army is loyal will not attempt violence—they have never attempted it until they have made sure of winning the troops over to their side. The troops will not be asked under any circumstances to fight labour; they will be fighting, if unhappily a fight ever comes, for all that labour holds dear. You soldiers here realise what you stand for; you stand for the honour of women, for the happiness of children, for the freedom of your country and for Christian civilisation. You are not only the

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soldiers of the King but the defenders of humanity. (Loud and continucd applause).

CHAIRMAN: I do not know what you all feel. I feel very much that Mrs. Webster has carried her point. There is no question about it that a revolutionary spirit is abroad in the country and has been abroad ever since 1776 and from what we read in certain papers which may be nameless, and what we hear talked there is no question about it but that there are agitators trying to seduce the allegiance of our younger soldiers. I should very much like to ask Sir John Longley if he would be good enough, as the Commander of the Area, to give us some sort of idea how best to counteract what may be coming, even if it has not yet come, in the way of temptation and seduction of our younger soldiers.

SIR JOHN LONGLEY: (who was received with loud applause): Lord Horne, Ladies and Gentlemen, I have been asked to give some idea as to how we are to combat this revolutionary spirit. That is opening up a very big question but I think in an assembly like we have here this afternoon we need only consider the question of what we should do, from a Military point of view, amongst our own troops. We shall have taken the first step if we realise that there is a danger and if we appreciate the fact that there is a very widely spread spirit of revolution abroad, not so much possibly in this country, but throughout the world in general. After hearing Mrs. Webster's lecture this afternoon, I feel perfectly certain we could not but entirely agree with her and realise the danger that there is. Then having realised the danger, I think it is next up to us to spread the idea of this danger amongst those about us and I think it is our duty to keep in touch with the feelings and the ideas of our soldiers. Personally I have always felt that it is a mistake to hide things and keep them in the dark, and if you want to know exactly what the ideas are of those about you, you had much better go and ask them straight away and have a heart to heart talk with them. (Hear, hear and Applause).

We have often in the past I think been convinced that the good sense of the British public is quite sufficient to prevent this revolutionary spirit spreading. We still think very highly of the good sense of the British public and we shall always do so, but we must now realise that we cannot trade, or go on trading for ever, on the good sense of the British public, and it is therefore necessary for us to take steps to combat this revolutionary spirit. I can only roughly indicate what the steps are that we should take I think in the Army. We should do everything we can for the good of those about us, for their comfort and for their well being. The life of a man in the Army has always been made as enjoyable and as comfortable for him as possible in the past. I think he has been very well looked after while soldiering so that when he comes to leave the Army he misses very much that feeling of somebody caring for him, he misses very much the spirit of comradeship, and he is thrown on his own resources entirely; so that it seems to me that if, in addition to looking after him while he is soldiering, we could do a little bit more perhaps to make things easier for him when he leaves, or we could induce those who are better able to look after him when he becomes a civilian again than we who are still soldiering; if we can induce

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them to care for him and look after him a little bit more then I think we shall have insured not only that he leaves the Army a contented man but that he remains a contented man after he leaves the Army. (Applause). While he is still in the Army let us, as I say, do everything we can to ensure that he leaves it with a contented mind and that he leaves it a better man than he was when he entered it. (Hear, hear). We should therefore do all we can to foster the spirit of loyalty that the Army has always been noted for. That spirit of loyalty is used in a general sense—loyalty to the King and loyalty to the Country, but what will inspire that loyalty undoubtedly is *esprit de corps*. (Applause). And I think if each one of us, whatever position we may be in, whether it is a small one or a higher one, does all he possibly can to keep up that spirit and so foster the feeling of loyalty throughout all ranks in the Army, we shall do a good deal to keep alight the fire of patriotism. (Hear, hear). And without that fire burning brightly things must go badly for our Empire.

I do not think it is necessary for me to say anything further; I could only go on repeating more or less what I have already said, but I feel sure that Mrs. Webster's lecture this afternoon has made a deep impression on one and all of us. (Hear, hear and Applause). I shall not return thanks to Mrs. Webster for her lecture because I leave that in better hands who will express it better than I can, but I think it has been a great privilege for us to have heard what she has told us this afternoon, and I am sure we shall remember what she has said and we shall do our best to act on it and consider from to-day the necessity of anti-revolutionary propaganda. (Loud Applause).

CHAIRMAN: Is there anybody in the room who would like to ask any questions of Mrs. Webster on the lecture she has delivered? She would be very glad to give you answers to your questions according to the best of her knowledge which is very considerable as you know. I do not know whether any of you Non-Commissioned Officers may have met men whom you did not know, who talked to you in barracks and have asked certain questions which seem to have very difficult answers. There are a lot of stock questions which are asked by people who are agitators more or less, and to the ordinary uninitiated person it is extremely difficult to find an answer. Now Mrs. Webster will be able to tell you the answers to a great many of these stock phrases and stock sayings you may have met with. If any of you will ask a question I am sure Mrs. Webster will do her best to answer it.

MRS. WEBSTER: Certainly. I know they have stock phrases.

CHAIRMAN: As nobody is leaping up to ask questions, it only rests with me now to ask you to join with me in giving a most hearty vote of thanks to our Lecturer who has put at our disposal the enormous fund of knowledge which she has collected. You do not collect it in a day; it means that for years and years she has been working and in one hour she has poured out to us the proceeds of many years of research. I can only ask you to give her in the usual way a very hearty vote of thanks. (Loud and Continued Applause).

MRS. WEBSTER: Thank you very much indeed for your very kind reception.

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SURPRISE, RAPIDITY, CONCENTRATION.

By Lieut.-Col. H. Rowan-Robinson, c.m.g., d.s.o., R.G.A.

THERE is no chapter in the art of war that offers a wider appeal both to the writer and student than that on the value of Surprise, Rapidity and Concentration, the three factors by which so many astounding victories have been achieved. Yet it is curious to notice how easily men who have been educated in their importance fail in their application. Their names are imprinted on every page of history and their work may be instanced in such varied operations as the conventional movements of the 17th century, some of our early efforts in South Africa and in the recent German failures before Riga and Libau. Thus it is that when a master comes along and appears to wield a magic wand, the magic lies just in these three factors properly applied. Napoleon was such a master, and surprise his happiest weapon. He liked to be ten years ahead of the tactics of his day and so confound his opponents by new methods of war. In these days of quick scientific development this is barely possible, for it is hard enough for even the most industrious to keep abreast of the times. It should, however, be our aim. And it can only be attained by constant study, by abjuration of prejudice and by making use of that faculty of imagination without which we may enter upon a new campaign to find it surprisingly out of accordance with expectations. The proof lies as much in failures as in successes. Take the conditions precedent to any great disaster. Before Jena the Prussians had studied indeed, but were in thrall to the obsolete formations of the Great Frederick; in the years leading up to Sadowa the Austrians rested on the laurels and traditions of 1814; before Sedan the French regarded the training and organization suitable for colonial campaigns as sufficient for a European war of the first magnitude. Issues were not decided by material influences such as the incidental possession of a needle gun or a mitrailleuse any more than they will be to-day by a Fokker or a Tank. Such factors are of contributive but not of decisive value. What is of vital importance is that tactics, training and organization should go hand in hand with scientific invention and that the effect of each new device, or development of existing devices, should be studied not only in its immediate and individual action but also in its relation to other arms in all the changing circumstances of war. In this fashion our peace studies may prepare us for the actualities of war and may even enable us to spring surprises at the outset of a campaign on less ready opponents. Generally speaking, in the campaigns quoted, the vanquished were beaten armies before they entered the field, because their leaders, owing to weak vision and lack of study, had allowed them to be surprised by unexpected conditions.

No such charge, however, can be levelled against the principal

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belligerents in the Western Theatre. Germany had for a hundred years studied military science with a devouring passion. Her succession of victories against Denmark, Austria and France were but fuel to the fire. The French General Staff had made a profound inquest into the causes of failure in 1870 and of the best methods with regard to numbers, psychology and terrain, of operating against their great opponent. Foch, Bonnal and Langlois were deservedly famous as military writers throughout the world. Again, for a proof of clear thinking and sane doctrine the British General Staff can point to their admirable Field Service Regulations, into whose tiny compass was compressed sound guidance as to the whole conduct of war as war was waged in 1914. The sole military fault that can justly be urged against the Great Powers prior to the recent Great War was a prejudice in favour of moving battle which, to an extent varying in each case, obscured such lessons of the Russo-Japanese war as had regard to the enhanced value of machine-guns, wire, spade-work, heavy guns and accurate gunnery. That the French were short of equipment and the British short of numbers were political rather than military mistakes; since, naturally, it is for the people to decide what expenditure is to be permitted upon their armed forces. Indeed, if ever we have the misfortune to take part again in a great war we shall have grounds for congratulation if we find ourselves as well prepared in point of doctrine and training as we were in 1914.

The value of a doctrine, however, lies neither in its teaching nor its learning, but in its application. If the doctrine preached and imbibed before the war was sound and can be shown not to have been fully applied in practice, there is proof that it had not been thoroughly assimilated and that the instilling process had not been sufficiently forcible. The truth is that for a doctrine to be truly effective it must permeate the mind so as almost to control it. It must in fact exercise the power over the High Command which discipline exercises over the private soldier in moments of the severest tension. "I do not want to possess a faith," said Rabbi Ben Ezra, "I want a faith to possess me." Only thus was Joffre, in the fury of the German assault, when the walls that he had built were falling about his ears in tempest of defeat and disaster, able to hold unshakenly to the French doctrine and patiently to build a *masse de manœuvre* to replace that which he had thrown into the fray; and when it was broken up to build it yet again; till finally finding his long sought opportunity in the enemy's faulty march, he hurled his hardly-collected divisions against von Kluck's exposed flank and drove back the invader at the height of his conquering career. The doctrine to fix the mind in the tumult of battle must be of the simplest kind. It should be limited to principles that have held through the ages and are therefore immune from fluctuations of opinion and developments of science. It is not necessary to quote them; they are known to every student of military history and though Einstein's theory has shaken such a fond and certain belief as that two sides of a triangle are necessarily greater than the third, the world's catastrophe has failed to shatter faith in a single one of the principles of war. In this essay it is only proposed to deal with those vital points expressed

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in the title, which formed an essential part of our pre-war doctrine, and to examine the extent of their application during the recent war by various belligerents.

The month of August 1914 afforded a masterly exhibition on the part of the Germans of the true application of the principles of war from a purely military point of view. The French General Staff, to judge from their orders for initial deployment clearly expected an enemy march through Luxembourg and the Ardennes, but the bold, wide sweep by Liège, through Brussels, to Mons completely surprised them, as did the vast concentration of force at the decisive point. The German enveloping movement was finely conceived and finely executed. Even in these days of an all-pervading intelligence system of aeroplanes, radios, telegraphs, newspapers and spies, its force and direction was long maintained a secret, and it was not until the 15th August that Marshal Joffre seems to have grasped, even in part, the imminence and extent of the impending stroke. More than anyone the Germans had realized the holding power of the machine-gun, with the result that Sordet tried in vain to penetrate their screen of cavalry and its support of maxims and lorry-borne Jäger detachments. Full stress, too, was laid on rapidity, in that von Kluck's right wing wheeled round at an astonishing speed and all but succeeded in shutting up the British Army in the fortress of Maubeuge. Secrecy, rapidity, concentration! They had found a rich reward in victories, in conquered country, in prisoners and guns. Yet there was one fault: the concentration at the decisive point might with advantage have been greater. It had been von Schlieffen's intention to refuse his left and to concentrate every man that could be spared on his right. The younger von Moltke, however, marred the original conception by an endeavour to be strong everywhere, and strengthened the left at the expense of the right.

The qualities that commanded success in the German manœuvre had won the initiative and robbed the French of the power of an adequate and immediate retort. Joffre, however, fought his losing battle well and, eventually deprived the German High Command of final victory and of many of the fruits of their early successes.

Then trench warfare supervened. That took all belligerents to a great extent by surprise, though sufficient indications were available from the Russo-Japanese war that it might ensue in the event of an early decision not being reached. The Germans indeed were better prepared for it than the Allies because they always expected to have to undertake the siege of great French fortresses and had equipped themselves accordingly. It was thought that a truly extraordinary war had come to pass, so much so that, after the new conditions had prevailed for a year or two, it was frequently suggested that all the old fetishes were obsolete and that the art as well as the science of war stood in need of reconstruction. If the Germans massed such overwhelming forces against our thin lines at the first battle of Ypres and failed, if one side or the other sought in vain after vast concentration to achieve penetration at Loos, Verdun and Vimy, how then were these fortified lines to be pierced? So hopeless became the outlook that it was commonly said that the war must end with the lines as they stood. The possibilities of the surprise gas-

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attack at the second battle of Ypres were not exploited, and the German thereby lost one of his finest opportunities. For the Allies, to pulverise the trenches and destroy the wire appeared to be the only solution. So from Neuve Chapelle onwards all efforts were concentrated on a gigantic accumulation of guns and ammunition. As attacks could not be successful without heavy preliminary bombardment; and as this process entailed early notice to the enemy, the possibility of surprise seemed to be excluded. The Higher Commands, in fact, resigned themselves to the apparently inevitable and sought to gain victory without the most potent weapon in the armoury of war. Had the doctrine of peace-days been fully ingrained in their minds, would they have accepted such a handicap? Would they not rather have argued; "The principles of war are constant; therefore they are the same in this war as in any other; therefore, to win battles, surprise, rapidity, concentration are all as necessary as ever. But with these huge transfers of men and material, this preparation of ground, this preliminary registration and bombardment, secrecy and surprise are out of the question. *Hence our present system must be wrong.* We must try again."

The secret transfer of troops is a possibility, within limits, if marches be executed by night and concealment be effected by day in towns, villages and woods, but it is impossible to bring troops up to the line in numbers sufficient for the execution of large operations without attracting attention. Enough, however, can be assembled, given suitable country and careful camouflage, for the requirements of the initial break through. Thus the Germans were able to utilise St. Quentin—a town our artillery was forbidden to shell—prior to the attack on the 21st March, and the great woods at Villers Cotterets concealed Mangin's concentration on July 18. The troops necessary for the continuation of the enterprise should be furnished from reserves so placed as to give no indication of the point of attack, arrangements being made for their rapid transport to the battlefield as soon as or just before the battle is joined. Such was Ludendorff's scheme in the March attack and most effective it proved.

The preliminary registration and bombardment were first dispensed with by the Austrians at Caporetto and then by us a little later at Cambrai, the work of the bombardment being done in the former case by propaganda and in the latter case by tanks employed for the first time in large numbers. In the earlier days we registered our guns by slow and obvious processes which gave clear indication to the enemy of the number, nature and positions of the batteries by which he was opposed; and the idea of opening fire at zero with unregistered guns had not been considered. There is but little doubt, however, that if the General Staff had at any time definitely asked the Artillery branch to solve this rather elementary problem, a solution would soon have been forthcoming. Here is a part of General Staff work that is sometimes neglected. The Artillery pursue their normal avocations: they cover the advance of the Infantry; they beat down the fire of the hostile guns. These have been their tasks for centuries, and every gunner devotes himself to them whole-heartedly, and, if of scientific attainments, he bends his mind to the evolution of technical improvements for their

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furtherance. But it is for the General Staff to furnish the inspiration to work on unturned soil. Having found certain changes in procedure to be a tactical necessity they should formulate their demands accordingly. The more they can think ahead, naturally the better, as the new requirements may involve not only changes in fire tactics but also alterations in equipment entailing much time in elaboration and manufacture.

The immense importance of backing to the utmost the effect of a new invention was never fully realized. It was only by some fresh device that the trenches could have been pierced, and once pierced, it was essential to draw the fullest profit from the opportunity. Thus the Germans might have achieved a decisive success with their gas and we with our tanks. It has been argued that the latter only achieved success eventually when, through the hard lesson of repeated failures, we had learnt to use them in combination with other arms. This is true enough, but only because we allowed them to fail in the first instance by not going the whole hog and putting large numbers in the field. *C'est le premier pas qui coûte.* Once the enemy has been able to adopt counter-measures, the chance of the new device achieving success by its own merits is past. It just falls into line with the old devices, becomes a fourth arm or a fifth arm, as the case may be, and exercises, according to its merits, a first or second class influence on the course of the struggle. Thus, later, the tanks exercised a first-rate influence, gas, perhaps, a second-rate influence—but in both cases the time of decisive effect had passed. It will stand, however, to the immortal credit of our High Command that it should have remained faithful to tanks at all after their comparative failure at the Somme and their complete failure at Bullecourt. To have pursued, in all thoroughness and in spite of failure, a policy that entailed an immense dislocation of industry with all its attendant evils, was a sign both of vision and resolution of a high order.

It was only after three years of war that the old doctrine began to tell once more. Caporetto, the two battles of Cambrai, the 21st March and Foch's succession of brilliant strokes from the 18th July onwards, the destruction of Bulgaria and Allenby's great victory, furnished a whole series of wonderful surprises. Camouflage, censorship, dissemination of false information, secrecy, particular care in keeping information from troops actually in the trenches, feints, absence of registration, the screen of woods and towns, extended use of mechanical transport for effecting rapid concentration—all played their part. On the Allied side the secrecy maintained by the Commander was perhaps the most potent factor in success. The number of Commanders successively brought "into the know" was kept down at the lowest limit compatible with the effective execution of their respective tasks. On the German side in 1918 the measure of success was in direct proportion to the secrecy maintained, the secret of the 21st March being well kept whereas full warning was given of the attack on the 15th July.

In the last stages of the war, therefore, the High-Commands were purged of heresies born of years of trench warfare. Surprise regained its place as the great weapon of offence. Till then con-

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centration had failed to play its part because it depends for effect upon surprise. If no secrecy be observed in concentration the enemy is able, where numbers are approximately equal, to carry out a like concentration, so that the marshalling of superior forces at the decisive point at the right time becomes an impossibility. Equal forces are assembled on both sides and a bloody and indecisive battle ensues. Superior force, it must also be remembered, is not a matter of mere numbers, for surprise lends a moral force that may attain a value reaching far towards infinity. In fact, in some of the most important successes achieved, such as Mangin's stroke in July, and the battles of Amiens and Bapaume, the surprise effect alone furnished the preponderance of force. Later on, Marshal Foch had sufficient troops at his disposal to ensure the concentration of superior numbers for every battle and, in the last stages of the war, the "big battalions" were crushing the heart out of the enemy resistance.

The saddest failure to concentrate sufficient numbers occurred at the first Battle of Cambrai. What could not another 80,000 men have effected if thrown into that glorious fight! Certainly the great German counterstroke would never have materialized, for the enemy would have been cast back on measures of pure defence. Certainly Cambrai would have fallen. But it is idle to speculate further, for the possibilities make a riot of imagination, bordering on military intemperance. The historian will always grieve that a stroke of genius was marred by the despatch of 5 divisions to Italy. Carporetto could have been redeemed far more effectively by a successful stroke in France—just as, on a smaller scale, Jackson's Valley Campaign relieved Richmond; but political considerations, the extent and depth of which have not yet been disclosed, were allowed to outweigh strategic necessities.

Rapidity never came greatly into play in the Western theatre. It was shown indeed in the quick transfer of troops from one point to another of that extended line, with a view to effecting concentrations and, in the latter half of 1918, by the speed in preparation insisted on by Marshal Foch in his successive blows. But for swiftness of movement and combination in the Napoleonic sense we must look to the Eastern theatre and study some of Ludendorff's fine work and Allenby's lightning stroke.

In the main theatre there was no instance of an effective pursuit on the part of the Entente troops. The writer has dealt with this question to some extent in a discussion on the comparative values of limited and unlimited objectives, and therefore the general advisability of pursuit will not be considered here, but merely its organization, if attempted. Rapidity is naturally the key-note, for the more rapid the pursuit the less the power of the enemy to organize effective resistance, owing not only to the disorder effected among his troops, but also to the destruction of his telegraphic communication and capture of his wireless stations. Generally too, the more rapid the pursuit the greater the spoils of war. But a pursuit to be effective requires most careful organization. The various elements in the pursuing forces should play definite parts, yet should work in the closest combination. In such pursuits as were attempted this plan was not always followed. The Whippets often regarded themselves

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as free lances off on a joy-ride. The Cavalry were generally thrown in either too early or too late. After the battle of Arras, for instance, too late; but after some of the later battles, where Whippets and Tanks were available, too early. To hurl Cavalry against an enemy in position, however thoroughly shaken, is to sacrifice vainly an expensive and valuable weapon. In the modern battle, if Cavalry be employed, it should be held back till the enemy is routed and then launched at the psychological moment to keep him on the run. Once serious opposition is encountered they must hold the front by dismounted action, seek a flank by covered ways, or, if other troops are available for ousting the enemy, water and feed in preparation for a further advance. The normal procedure would be that Tanks and Infantry break the line; Whippets, followed by the Cavalry and by Infantry in lorries take up the pursuit. The Whippets should work on a definite plan. Where the enemy's resistance interferes with the plan, Infantry brought up in lorries supported if necessary by Tanks and guns, exercise pressure till the enemy breaks again and the plan can be resumed. So the pursuit continues until a rout ensues when the Cavalry is launched and Cavalry and Whippets together complete the victory. The Infantry following in lorries is ready at all times to break a fresh line, repulse a counter-attack and make the necessary arrangements for collecting and guarding prisoners. Gunners, also in lorries, complete the combination by making use of the captured guns. If roads are destroyed in parts all available caterpillar transport is used to bridge the gap by towing troop and supply-lorries round the damaged portions. When lorry roads do not exist caterpillar vehicles do the whole of the transport work. Cavalry may vanish from the field of battle, and its place will be taken by additional Whippets. The plan of operation suggested will then be much simplified, for the Whippet of the future will have all the mobility of Cavalry without being so vulnerable. In ill-roaded countries and against weak armaments Cavalry will still fulfil its rôle.

The pursuits carried out by the Germans in March and May 1918 were the most effective that took place on the Western front. Between the 21st March and the 4th April, by unrelenting pressure, they drove the 5th Army from the edge of St. Quentin to the heights E. of Villers Bretonneux—as the crow flies a distance of forty miles—and were within an ace of achieving decisive results. Yet even here the victors appeared to be surprised by the extent of their success and not prepared to press the advantage to the full. There were times when Whippets or an active Cavalry supported by Infantry in lorries and armoured cars could have reaped a rich harvest. The Germans fully expected, and not unnaturally, to be held up on the line of the Somme and had made no arrangement for the rapid bridging of the river or for the improvement of the existing bridges, and thus, in spite of our own failure at effective destruction, allowed the great mass of supply columns on the far bank to escape. There was the less excuse in that the roads except at a few points, were in splendid order.

While criticising this great advance, however, let us cast our minds back to those desperate days in March and April and recall its terrible effect both at home and abroad. After all the years of suffering and sacrifice, defeat and final defeat appeared imminent.

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Even in Merrie England women were buying poison against the horror of a Hun invasion. The Americans still across the water; the French troops on whom had fallen the main burden of war, decimated and yet decimated again; the British Army on whom all hopes were centred reeling backwards to the heart of France! Such was the situation! The mass of the nation indeed retained its invincible courage. With unwavering spirit and infinite resource our leaders, both political and military, restored the battle, but it was a near thing; and it behoves us, therefore, to study the means by which Ludendorff obtained such a measure of success, even more than the causes of his failure to achieve complete victory. As already stated, his preparations were taken to some extent as a model for Foch's later battles, but of the discard of a part of his artillery no notice was taken, and his method of employing *Sturmtruppen*—that is troops specially selected, trained and equipped for an impending operation and intended to furnish the spearhead of the advance was regarded as unsound. The case of *Sturmtruppen* is perhaps worthy of further consideration, though it should be borne in mind that the innovation was partly due to scarcity of transport, owing to which German divisions remaining in the line had to be severely "milked" in order to render truly mobile the divisions detailed for the attack. On our side the value of such troops were shown in the great performances of the Australian troops, men who were not only fine natural soldiers and of good physique, but actually the only volunteers fighting in the last year of the war in any theatre and therefore, practically speaking, selected men. Australia by refusing conscription had put forward a lower percentage of her man-power than the other portions of the Empire and in doing so had naturally maintained a higher relative standard. Hence some of the astounding feats of valour—that deep advance on August 8th, the capture of Mont St. Quentin and the breaking of the Hindenburg line. If, therefore, the case for *Sturmtruppen* found no triumphant vindication, at least the case against them may be regarded as 'non-proven'. There is this to be said, too:—that though we may disapprove of them ourselves, they have come to stay in other armies and therefore their nature and habits should be studied in order to take the counter-measures necessary for the defeat of their activities.

The general contention of this paper is that Surprise, Concentration and Rapidity are as essential as ever to the successful prosecution of war; that, in the Western theatre, the Allies never made full and continued use of these weapons, concentration being used, then concentration and surprise, but never all three in unison; that, whatever be the developments in war-engines and however greatly strange innovations may appear to alter the face of war, no leader should ever allow himself to be blinded to the value of these three important factors.

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GAMBLING AND GROUPS.

(Being a sequel to Betting and Brackets).

By Captain D. R. D. Fisher, d.s.o., R.F.A.

PART I.

Introductory.

The conclusion which we reached in the previous articles was that the bracketing method had attained its limit of usefulness in the verified true short bracket, with its even-money chance that the target lies somewhere inside the 50% zone of the gun at the intermediate elevation. If a higher degree of accuracy is required it must be sought for in some other method, and the normal procedure is to fire a group of rounds at the intermediate elevation and, by one means or another, to make certain deductions from the resulting fall of the shot. It is with these methods of deduction and their comparative reliability that we are primarily concerned in this article, but before embarking on a discussion of them it will be as well to examine the general properties of a group as it is ordinarily understood—that is, the pattern produced by a small number of rounds fired at the same elevation and as far as possible under the same conditions.

General Properties of a Small Group.

Let us however start with the investigation of the two extreme cases of groups, that is the infinitely large group and the group, if we may call it so, of a single round: for between these two extremes our ordinary group lies, and its properties will be a compromise between theirs and may more easily be arrived at by this round-about method.

(a). An infinitely large group is of course the last word in abstract truth. Its mean point of impact is the true M.P.I. of the gun at the elevation concerned and under the conditions prevailing; its rounds are distributed in exact accordance with theory, i.e. in exact agreement with the Probability Factors; and its 50% zone is the true 50% zone of the gun, not only in size but also in its position on the ground with reference to the true M.P.I., which is its centre. Absolute truth on this generous scale is naturally never encountered in real life; nevertheless it is found in practice that with all ordinary natures of gun and howitzer a group of 100 rounds gives results in close agreement with theory, particularly as regards the size of the 50% zone, which seldom differs materially from that given in the Range Table.

(b). But a single round is not prodigal of absolute truth even when we call it a group; we have in practice a reasonable degree of certainty that it is somewhere inside the 100% zone of the gun, but

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that is all. If however we consider it as one round of an infinitely large group we can extract some further information. Since half the rounds in such a group will fall inside the true 50% zone, it follows that any particular round has an even-money chance of doing so; but as the true M.P.I. is at the centre of the true 50% zone, no round in that zone can be at a greater distance than half the true 50% zone from the true M.P.I.; in other words each individual round has an even-money chance of falling within a distance equal to half the true 50% zone from the true M.P.I. This distance is called, rather unhappily, the Probable Error, not because it is the error most likely to occur nor even the average error, but because it is the error which 50 times out of 100 will not be exceeded. We may say then that the Probable Error of a single round with reference to the true M.P.I., is half the true 50% zone of the gun.

(c). Now for our ordinary group: we may safely assume that neither the size nor the position of its 50% zone, nor the position of its M.P.I., will agree with the truth, that is to say, with those of an infinitely large group. What we are chiefly interested in determining is the relation between its M.P.I. and the true M.P.I., and here unfortunately we must abandon argument and take refuge in an assertion the proof of which is beyond both the scope of this article and the mathematical powers of its author, namely that:—

"The Probable Error of things taken n at a time equals their Probable Error taken one at a time divided by the square root of n."

But in our case "the P.E. of things taken one at a time," i.e., of single rounds, has been shown to be half the true 50% zone, which for all practical purposes is equivalent to saying half the Range Table 50% zone. We may therefore conclude that:—

"The P.E. of the M.P.I. of a group of n rounds equals half the R.T. 50% zone divided by $\sqrt{n}$."

Mathematicians can work out this conclusion for themselves: sceptics may find comfort in the assurance that it has been substantially confirmed in practice.

Properties of the Four-round Group.

So much for the generalities: let us now take a concrete case, and what more suitable than the four-round group, until recently an almost universal favourite? Let us see whether a detailed examination of its merits and defects will disclose to us the secret of its fall from grace. We will conduct our inquiry in three distinct stages.

(a). When the M.P.I. of the group can be exactly determined. This of course implies that the fall of the shot can be accurately measured with reference to the target or some other fixed point, a state of affairs that does not often obtain in practice but which nevertheless is worthy of consideration. We have only to refer to the conclusion to which we have just come to see that the Probable Error of the M.P.I. of a group of four rounds equals:—

$$\frac{\frac{1}{2}\text{ R.T. 50\% zone}}{\sqrt{4}} = \frac{\frac{1}{2}\text{ R.T. 50\% zone}}{2} = \frac{1}{4}\text{ 50\% zone.}$$

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Since the Probable Error is necessarily expressed in terms of the R.T. (or true) 50% zone, it will make for brevity if we represent the latter by a symbol; let us call it F, and say that the P.E. of the M.P.I. of a group of four rounds, with reference to the true M.P.I. is ·25 F.

(b). When a group of four rounds gives two pluses and two minuses.

In this case there is no question of extracting an M.P.I.: what we want to determine is the relation between the gun elevation and the target, the idea of course being that the true M.P.I. of the gun should coincide with the target. In other words what we are after is the P.E. of the true M.P.I. with regard to the target, and it cannot be too strongly emphasized that we take no interest whatever in the actual M.P.I. of the four rounds, knowing as we do that it is exceedingly unlikely to coincide with the true M.P.I.

We will in the first instance solve the problem by the graphical method adopted in the previous articles on brackets, and in order to save reference to them it may be as well briefly to recapitulate the successive steps.

(i). Take any convenient straight line to represent the 100% length zone of the gun, and graduate it in terms of the Probability Factors (A.A′, Fig. 1).

(ii). On it erect the "Chances of a plus" curve, the perpendicular at any point representing on any convenient scale the chance of any particular round giving a plus of a target at that point, as deduced from the Probability Factors.

Example. Target at X (Fig. 1.a): corresponding Probability Factor 1·0, showing that X is at the near end of the 50% zone, and that 75% of the rounds may in consequence be expected to fall between X and A′, i.e., plus of X. The chance of any particular round falling plus of X is therefore ·75, and the perpendicular XP_1 is erected accordingly.

(iii). On the same base erect the "Chances of a Minus" curve. Since each round must be either plus or minus of any particular point in the pattern (a direct hit on a mathematical point not being contemplated) it follows that at any particular point the chance of a plus added to the chance of a minus equals unity: e.g., the chance of a plus at X (Fig. 1.a) being ·75, represented by XP_1, the chance of a minus is represented by $XP_2 = 1 - ·75 = ·25$.

(iv). The chance that any two rounds will give a plus and a minus of any particular point is the product of their individual chances: in this way the "Plus and Minus" curve is compiled (Fig. 1.b).

Example. Target at X (Fig. 1.b). The individual chances of a plus and a minus at this point are ·75 and ·25 respectively, represented by XP_1 and XP_2 (Fig. 1.a): the chance of a plus and minus in a two-round group is therefore $·75 \times ·25 = ·19$ approximately, and this chance is represented in Fig. 1.b by the perpendicular XP_3, a larger scale being employed for the sake of clearness.

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(v). The curve showing the comparative chances that a group of four rounds will give two pluses and two minuses of a target at any particular point in the 100% zone is arrived at by squaring the chance of getting one plus and one minus at each such point. (Fig. 1.c).

FIG. I. THE FOUR-ROUND GROUP.

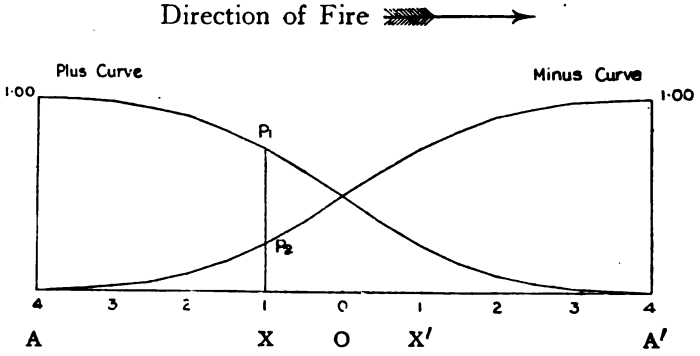

Fig. 1. (a) The separate 'Plus' and 'Minus' Curves.

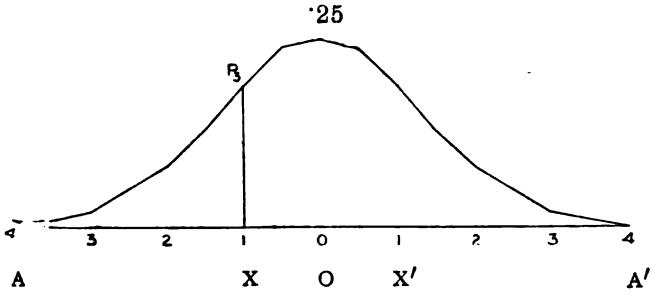

Fig. 1. (b) The 'Plus' and 'Minus' Curve.

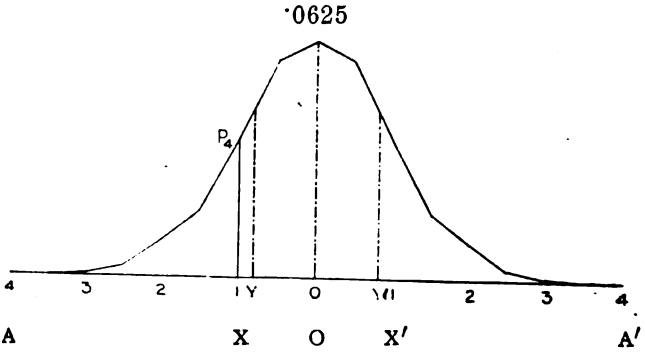

Fig. 1. (c) The Curve of 2 Pluses and 2 Minuses.

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Example. Target at X (Fig. 1.c). The chance that any two rounds will give a plus and a minus of this point is ·19, represented by XP_3 (Fig. 1.b); the chance of two pluses and two minuses in a four-round group is therefore ·19 × ·19 = ·036, and this chance is represented in Fig. 1.c by the perpendicular XP_4, a still larger scale being again necessary for clearness.

(vi). When two pluses and two minuses have been obtained on a target, the chance that that target lies in any particular portion of the 100% zone is given by:—

$$\frac{\text{the area subtended by that portion}}{\text{the total area of the curve}}.$$

Example. The chance that a target on which two pluses and two minuses have been obtained lies between X and X′ (Fig. 1.c), i.e., inside the true 50% zone of the gun, is given by:—

$$\frac{\text{the area subtended by X X}'}{\text{the area subtended by A A}'}$$

and this works out to approximately ·69; in other words, when a group of four rounds has given two pluses and two minuses of a target, that target will be inside the true 50% zone of the gun on 69 occasions out of 100, say 7 times out of 10: a conclusion which, it may be recalled, was anticipated in the previous article.

(vii). When a group of four rounds has given two pluses and two minuses of a target, it is however natural to assume that the elevation is correct, i.e., that the true M.P.I. and the target more or less coincide. No other assumption is indeed possible in practice, and what we want to ascertain is the Probable Error which it involves, bearing in mind that the P.E. is that which 50 times out of 100 will not be exceeded.

Let us turn back to Fig. 1.c and by trial and error insert a point Y, such that:—

$$\frac{\text{the area subtended by Y O}}{\text{the area subtended by A O}} = \tfrac{1}{2}.$$

Now let us insert a point Y′, such that YO = OY′; then, since the curve is symmetrical, it follows that:—

$$\frac{\text{the area subtended by OY}'}{\text{the area subtended by OA}'} = \tfrac{1}{2},$$

and consequently that:—

$$\frac{\text{the area subtended by YY}'}{\text{the area subtended by AA}'} = \tfrac{1}{2}.$$

But this last expression represents the chance that a target on which 2 pluses and 2 minuses have been obtained lies somewhere between Y and Y′, consequently there is an even-money chance that the target lies between these two points; i.e. 50 times out of 100, its distance from O will not exceed OY.

The Probable Error involved in assuming that the target is at O, i.e. that it and the true M.P.I. coincide, is therefore equal to

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YO, which proves on examination to be approximately one-third of the 50% zone or ·33 F, as compared with ·25 F, the P.E. involved in accepting the M.P.I. of a group of 4 rounds as the true M.P.I. We will for the moment abstain from comment on this result.

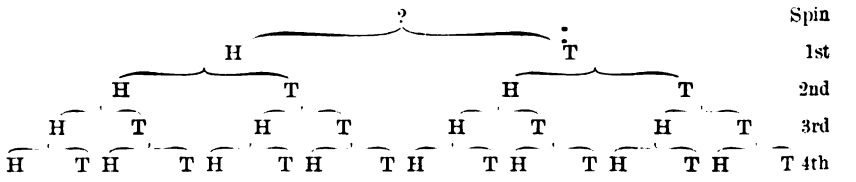
(c). Where the true M.P.I. and the target coincide.

So far we have been concerned with a group of 4 rounds which gave us two pluses and two minuses on our target, and we have seen that where this result has been obtained there are strong grounds for supposing that the elevation is more or less correct, the Probable Error involved in making this assumption being ·33 F: let us now consider what chance we have of obtaining these 2 pluses and 2 minuses in the circumstances most favourable to them, that is when the true M.P.I. and the target do in fact coincide. There are manifestly four other combinations of plus and minus that may occur, namely 4 plus, 3 plus and 1 minus, 1 plus and 3 minus, and 4 minus, any one of which would lead us to suppose that the elevation of the gun required modification; let us see whether there is any serious danger of so misleading a result.

If we exclude the possibility of hitting a mathematical point, it follows that every round must fall either plus or minus of the target, and when the target coincides with the true M.P.I. it is clearly an even-money chance which side of the target any particular round falls, i.e. whether it is a plus or a minus. But similarly, when a coin is spun it is an even-money chance whether any particular spin will produce a head or a tail—if we exclude the possibility of the coin standing on its edge; and as the two cases are exactly parallel it will be convenient to examine the order of frequency of the various combinations of plus and minus in a group of 4 rounds in the light of the more familiar behaviour of the spin of a coin.

The equally probable permutations of heads and tails taken 4 spins at a time may be best illustrated diagrammatically, bearing it in mind that, whatever the preceding spin, any particular spin may be equally probably a head or a tail: no matter if heads has turned up ten times running, there is still no more than an even-money chance that the next spin will be tails.

DIAGRAM OF FOUR SPINS OF A COIN.



From this diagram we see that there are 16 equally probable permutations, namely:—

HHHH	HTHH	THHH	TTHH
HHHT	HTHT	THHT	TTHT
HHTH	HTTH	THTH	TTTH
HHTT	HTTT	THTT	TTTT

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But we are interested not in permutations but in combinations, not in the order in which heads and tails occur but in the final result of 4 spins; and these 16 permutations, all of which are equally probable, will be found to contain the 5 possible combinations as follows:—

HHHH TTTT, once each;
HHHT HTTT, 4 times each;
HHTT 6 times.

Hence in the most favourable circumstances, i.e. when the elevation is ideally correct and the true M.P.I. coincides with the target, 2 pluses and 2 minuses (HHTT) will on the average occur only 6 times out of 16; more frequently indeed than any other individual combination, as was only to be expected, but that is not the point. What do we require of a group? Not only that we should be able to believe it when it tells us we are right, but also that we should place equal reliance on it when it tells us we are wrong. We have already seen that when a four-round group tells us we are right, i.e. when it gives us 2 pluses and 2 minuses, we are reasonably justified in believing it. Now however we see that we can place no reliance on it when it tells us we are wrong, i.e. when it gives us any other combination of pluses and minuses; because even when we are ideally and impossibly right, for every six times that a four-round group admits our skill and good fortune it will on ten occasions endeavour to persuade us that we are wrong. It is this deceitful trait that has caused the four-round group to be officially abandoned in favour of that of 5 rounds, the properties of which we will investigate presently.

Analysis of the examination of the Four-round Group.

Since we now desire to investigate a group of 5 rounds and possibly still larger groups, it will be as well to review the process of examination of a four-round group which we have just completed, with a view to discovering any available means of arriving at the required results by less cumbrous methods. Let us consider the question step by step in the preceding order.

(a) As regards the Probable Error involved in accepting the M.P.I. of a group as the true M.P.I. there is nothing more to be said; the formula is already reasonably simple.

(b) But the construction of the curve showing the relative chances of obtaining 2 pluses and 2 minuses on a target at any point in the 100% zone (Fig. 1.c.) admits of very considerable simplification. How did we arrive at the perpendicular XP4? By saying that with a target at X the chance of getting a plus is ·75, that of getting a minus ·25, that of getting a plus and a minus ·75 x ·25, that of getting 2 pluses and 2 minuses $(·75 \times ·25)^2$ that is $·75^2 \times ·25^2$: all of which might have been done arithmetically instead of graphically. In other words, if the chance of getting a plus on any particular target is x and that of a minus is y, the relative chance of getting 2 pluses and 2 minuses is $x^2 y^2$; a particular identity that we will venture to expand into the statement that:—

'The relative chance that a group of $(m + n)$ rounds will give m pluses and n minuses of a certain target is given by the expression

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$x^m y^n$, where x and y are respectively the chances that any particular round will be plus or minus'.

It seems possible in this way to construct the curve corresponding to any particular combination of pluses and minuses without going through the laborious process of building it up graphically step by step. Let us test it by examining a concrete case: What is the chance that a group of four rounds will give 3 pluses and 1 minus when the target and the true M.P.I. coincide? Here each round has an even-money chance of being either plus or minus, i.e. $x = y = \cdot 5$; and $x^3y = \cdot 5^3 \times \cdot 5 = \cdot 0625$ or $\frac{1}{16}$

But we have already seen that this combination will occur not once but 4 times in 16, which suggests that the expression x^3y gives us not the chances of getting 3 pluses and 1 minus but those of getting one particular permutation of 3 pluses and 1 minus. We are thus driven to the conclusion that our expression $x^m y^n$ requires the addition of a constant factor, in this case 4, corresponding to the number of permutations in the combination concerned. Hence the curve that we require is strictly speaking that of $4x^3y$, not x^3y, but as we have so far employed a purely arbitrary vertical scale and concerned ourselves merely with the comparison of areas in the same curve, no harm has been done and our results are in no way invalidated.

(c) Let us now examine the combinations; they were HHHH once, HHHT 4 times, HHTT 6 times, HTTT 4 times and TTTT once.

The total combination may be written:—

$H^4 + 4\,H^3T + 6\,H^2T^2 + H.T^3 + T^4$, which is the expansion $(H. + T)^4$.

Substituting x and y for H. and T we get:—

$$x^4 + 4x^3y + 6x^2y^2 + 4\,x\,y^3 + y^4 = (x + y)^4.$$

But x and y are the chances of getting a plus and a minus respectively, and at any point $x + y = 1$, since every round is certain to be either a plus or a minus; the expression therefore becomes:—

$$x^4 + 4x^3y + 6\,x^2y^2 + 4\,x\,y^3 + y^4 = 1.$$

In other words, if on the same base we construct the five curves corresponding to the 5 possible combinations of plus and minus, the sum of the 5 perpendiculars at any point will be equal to unity, illustrating the undoubted fact that wherever the target may be a group of four rounds is certain to produce one or other of these 5 combinations. But what is true of a group of 4 rounds may similarly be proved true of any other group; let us therefore accept without more ado that:—

'With a group of n rounds, the curve showing the true as opposed to the relative chances of obtaining any particular combination of pluses and minuses is that given by the appropriate term of the expansion of $(x + y)^n$.'

We have now cleared the way for our examination of the merits and defects of a group of five rounds.

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The Properties of the Five-round Group.

(a). The Probable Error involved in accepting the M.P.I. of the group (supposing that we have the means to determine it) as the true M.P.I. is $\frac{\cdot 5F}{\sqrt{5}} = \cdot 22F$, say one-fifth of the 50% zone.

(b). What are the chances of obtaining two pluses and three minuses or vice versa when the elevation is correct, i.e. when the true M.P.I. coincides with the target?

$(x + y)^5 = x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + y^5$.

Hence x^3y^2 and x^2y^3 together occur 20 times out of 32, and the chance of obtaining either one or other of these combinations is in the circumstances $\frac{20}{32} = \cdot 625$, approximately 2 to 1. In other words, if

FIG. II. THE FIVE-ROUND GROUP.

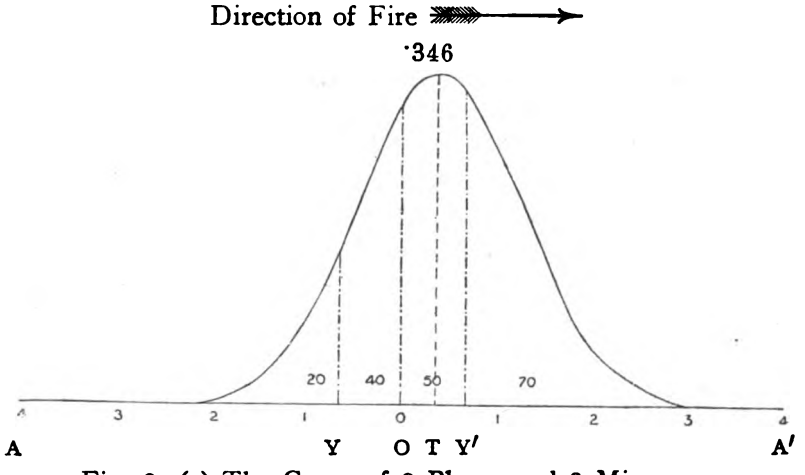

Fig. 2. (a) The Curve of 2 Pluses and 3 Minuses.

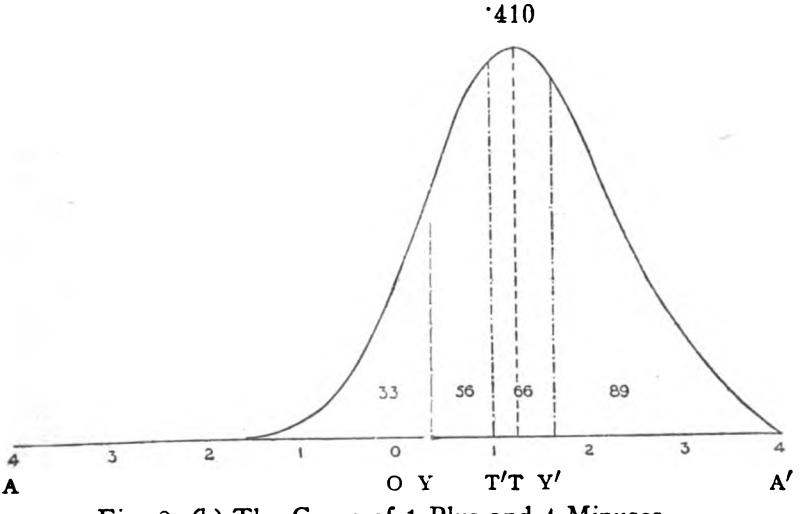

Fig. 2. (b) The Curve of 1 Plus and 4 Minuses.

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the elevation is correct a five-round group is considerably more likely than not to tell us so, and this constitutes its unquestionable superiority over one of 4 rounds.

(c). The curve representing the true chances of obtaining 2 pluses and 3 minuses is given by the expression $10\ x^2y^3$ and is reproduced in Fig. 2.a. As the proportion of pluses and minuses is now unequal the curve is not symmetrical, and the maximum chance (·34) of obtaining this combination naturally occurs when the target (T) lies a little beyond the true M.P.I. (O); in Fig. 2.a., OT = ·19 F, say one-fifth of the 50% zone. Let us nevertheless assume that 2 pluses and 3 minuses indicate that the elevation is correct, i.e. that the true M.P.I. and the target coincide: what is the Probable Error involved in this assumption?

As before we insert two points Y and Y′ such that YO = OY′ and that:—

$$\frac{\text{the area subtended by YY}'}{\text{the total area of the curve}} = \frac{1}{2}.$$

Now it is an even-money chance that the target lies between Y and Y′, consequently the Probable Error involved in assuming it to be at O is OY, which works out to ·33 F approximately, say one-third of the 50% zone.

The curve for 3 pluses and 2 minuses is obviously equal and opposite to that for 2 pluses and 3 minuses, and need not be reproduced. We may therefore conclude that the Probable Error involved in accepting either combination as an assurance that the elevation is correct is ·33 F, naturally exactly the same as that with 2 pluses and 2 minuses—but we have already condemned the four-round group on other grounds.

(d). But suppose our group gives us say 1 plus and 4 minuses: our elevation apparently wants increasing, but how much?
Fig. 2.b. shows the appropriate curve, namely that of $5xy^4$, and from it we see that the maximum chance (·41) corresponds to a target at T, approximately ·6 F beyond the true M.P.I. (O): Let us however assume that the target is at T′, i.e. that the true M.P.I. is half the 50% zone instead of ·6 F short of the target. Now carry on as before.

$$\text{YT}' = \text{T}'\text{Y}'; \quad \frac{\text{Area YY}'}{\text{Total Area}} = \frac{1}{2}; \quad \text{P.E.} = \text{YT}'.$$

On examination YT′ proves to be equal to ·32 F. What does this imply? That the Probable Error involved in accepting 3 pluses and 2 minuses or vice versa as an indication that the elevation is correct, i.e. that the true M.P.I. coincides with the target, is the same as that implicit in the assumption that 1 plus and 4 minuses indicate that the true M.P.I. is half the 50% zone short of the target; the Probable Error in both cases being approximately one-third of the 50% zone. Does not this suggest that at all events in theory any proportion of pluses and minuses and not only an approximately equal proportion, may be used to establish a definite relation between the true M.P.I. and the target? In the next article we will examine the ten-round group from this aspect and compare the theoretical results with those actually obtained in practice, with a view to discovering the limitations of the method and in the hope of deducing a simple rule for its application.

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A HISTORY OF ARTILLERY.

PART IV. (Continued).

1783 TO 1815: QUO FAS ET GLORIA DUCUNT.

By Ralph Flenley.

(Continued from page 448.)

The expedition to recover Hanover in 1805 returned without fighting and needs no attention. More important was the effort of the next year resulting in the acquisition of the Danish fleet. Some artillery of the King's German Legion had gone with Cathcart to Swedish Pomerania before the discovery of the secret clauses of the Treaty of Tilsit caused the sending of the expedition to Copenhagen, and it returned there to join the main force. For this General Blomefield commanded nearly a thousand British and seven hundred German artillerymen, with half as many drivers and 185 pieces of Ordnance, from 6 to 24-pounders, 5½ to 10-inch howitzers, mortars up to 13-inch, and a few 68-pounder carronades. The lighter pieces, it is worth noting, were definitely organised in batteries. Beyond the actual investment and siege of Copenhagen, not the pleasantest episode in the history of British arms, the field guns had some work to do both in checking the activities of the Danish gunboats and, two of them, with the reserve under Wellesley in successfully defeating an attempt at relief by a Danish force. By the 2nd September when fire was opened on the town some 70 or 80 pieces of heavy ordnance were in batteries along the land face of the town. Three day's bombardment secured the desired capitulation and the artillery received "in a particular manner" the thanks and commendation of Lord Cathcart for their share in an arduous if little fatal operation. Last of these expeditions near home waters, if we omit for the moment that of 1815, was the attempted stroke at the Scheldt in 1809. The army, and even more the artillery, had so grown by this time that to the force of 40,000 men went no less than sixteen companies of the regiment, with one troop of horse artillery, over three thousand officers and men counting the drivers, with 70 guns 74 mortars, and nearly two thousand horses. General Macleod commanded the artillery, Lord Chatham, Master General of the Ordnance, the whole force. Again and this time all too fatally, the result was by no means proportionate to the effort expended; in fact as a whole the expedition was a ghastly failure. That is no reason for not lingering over it but indeed like that of ten years earlier to the mainland, the Walcheren expedition taught artillerymen little, save this time how to die of fever. The field artillery was landed and one battery was alloted to each of the three columns for the advance on Flushing, sharing in the skirmishing which accompanied that advance. The heavy guns were likewise landed and with infinite toil dragged over

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the heavy ground for ten miles by hand for the siege of Flushing. There they were set up in battery, and after two days' firing, secured the surrender of the fortress, helped by the guns of the fleet from the seaward side. But then down came the fever like a cloud and in death and withdrawal the expedition ended.

The operations in which artillery was seriously engaged in the Mediterranean include those at Toulon, in Sicily and Italy, in the Ionian islands and in Egypt. In regard to Toulon the attempt to hold the place with the small force available was doomed to failure from the start. Only one company of artillery, for example, could be spared for the defence, that under Captain Koehler which was sent there from Gibraltar. After an occupation of four months, the situation worsening as the French attack increased in vigour, strengthened by the appearance of the young gunner officer Bonaparte, the British withdrew. Koehler and his company successfully discharged their allotted task, covering the embarkation with the guns of the last fort held, Fort La Malgue, before spiking them and leaving the place. The operations in and near Italy are too long drawn out and tortuous for any attempt to follow them. A number of artillerymen had accompanied Craig's force to Malta in 1805 and nearly three hundred of them, making three batteries, armed with four 12 and eight 6-pounders and four howitzers, accompanied his force of 7,000 men to the mainland of Italy in the same year, suffering from the usual shortage of horses. Retiring to Sicily the force garrisoned the island for a time. Under Stuart in the next year 5,000 men of this force again crossed to the mainland, the artillery armed with 6-pdrs. and a number of 4-pounders capable of being carried on mules, presumably guns acquired in the island, and taken for their lightness. Major Lemoine commanded the artillery on this occasion. The battle of Maida which followed the incursion is remembered now mainly as an early instance of the conflict between British line and French column and has not much artillery interest. Reynier, who commanded the French, had about a thousand more men than Stuart and had also a battery of horse artillery, but the forces engaged were in any case small and the guns proportionately few in number. The action, it is true, was highly successful for the British but it was highly confusing and discursive in its nature, not to be described in a few words despite its small scale. After it the force returned to Sicily and there, reinforced by fresh troops including two companies of artillery, we must leave it, for the later activity among the Ionian islands was comparatively unimportant.

There were two expeditions to Egypt during this period, one in 1800-01 and the other in 1807. The former was to act in concert with the Turks against the French force left in Egypt by Napoleon, and Colonel Koehler had taken a party of artillerymen to Constantinople in 1798 to assist in re-organising the Turkish army. Despite this, however, the Turks were entirely unready and Abercromby's force spent seven weeks waiting for them on the coast of Asia Minor. The time was not altogether wasted. The force of 16,000 men was most carefully practised for their task of landing on a dangerous, hostile and destitute shore. Indeed some of the interest of the

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expedition for artillerymen lies in the detailed account[1] of such training and preparation left us by General Lawson who commanded the seven hundred artillerymen with their guns and mortars of all calibres from light 6 to 24-pounders, 5½ to 10-inch howitzers and mortars. Also some of the blunders and deficiencies of the Board of Ordnance were made good so far as possible. It was in the main a question of making the artillery mobile enough for transit over desert and bad ground, for this was the first of many desert expeditions the regiment was to share in during the century then opening. In a wider way Lawson's efforts illustrate the general struggle for mobility characteristic of the period. "Every reform possible was made", says Lawson, "to lighten the travelling of the ordnance." Horses of course were short. Some had been bought in Constantinople for the cavalry and those rejected by them—and the cavalry could not afford to be squeamish about their horse flesh—were handed over to the artillery, a not infrequent way of horsing the artillery at this time as the Peninsular War shows. They were "poor undersized animals" unable to bear the harness brought for them. Ammunition packs for mules and camels, and 'horse barrows' for the same purpose were improvised; gun carriages were altered for the lighter carronades; a 3-pounder horse artillery troop was created, with double instead of single draught and seats for the gunners on the gun carriages and off horses. Once landed, the difficulties of transport were at least as great as had been anticipated and no amount of labour or ingenuity could make up for the lack of animals. In the engagements of 13th and 21st of March the French had a superiority in the amount of artillery, as in its being well posted. In the latter and more important of the two engagements the British guns exhausted all their ammunition and, despite all Lawson's arrangements, lack of transport for it caused delay in bringing fresh supplies, though it came in time to complete the defeat of the French. The remainder of the campaign was one of difficult marches and siege operations, not the least difficult of the former being that undertaken across one hundred miles of desert from the Red Sea by Baird's force from India in which three companies of artillery, two from India and one from the Cape, shared.[2] Whilst it took almost superhuman exertions to get the heavy guns in position before Alexandria, they were in action only a week before the French came to terms, the French being in fact as anxious to return to France as the British were to send them there. To the companies and detachments of the regiment which had taken part in the expedition, the permission to wear as a personal distinction the badge of the Sphinx with the word Egypt inside it, which came in 1803, meant the successful learning of fresh lessons in yet another new and strange field. The expedition of 1807 must be dismissed with a word or two. Something under two companies of artillery accompanied the force of about 6,000 men which left Sicily under General Mackenzie. Alexandria, the primary objective of the expedition, was occupied without difficulty or delay but two attempts against Rosetta failed with loss both of men and guns.

[1] General Lawson's narrative has been printed by Duncan, ii, 111 seq., and in Min. Proc. R.A. Inst., xii, 1884, p. 207, seq.
[2] Fortescue, iv, ii, 858-59.

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Guns and gunners of the regiment had been crossing the Atlantic to the West Indies for fifty years in conflict with France or Spain before the last great struggle of the century. There were detachments of artillerymen doing garrison work on the different British islands when the war broke out. And there is nothing new in the manner or so remarkable in the extent of their work there during the war. For them as for the whole army, the West Indies were costly from disease rather than from fighting. We cannot even begin to recount the many occasions on which the artillery was usefully employed or rendered vital assistance, in the last fighting between England and France there. Then, as earlier, the presence on every island of one or more fortified strongholds, usually better supplied with guns than with men to man them, almost always made artillery an essential to successful attack; and these miniature siege operations were of course dependent on local as well as general command of the sea, and naval co-operation. From the day of 12th April 1793, when half a company of artillery left Barbadoes with General Cuyler's force of 500 men for the capture of Tobago, to February 1810 when with the fall of Guadaloupe the French flag practically disappeared from the islands, the artillery shared in the enterprises and counter-enterprises which fell to the lot of the British soldier there. The operations varied from sieges such as that of Fort Desaix in Martinique in 1809 when 42 heavy British guns and mortars battered the place for five days continuously night and day until it surrendered, to enterprises such as that of the howitzer detachment which in 1795 accompanied two companies of dismounted dragoons into the hill country of Jamaica "where white men had never penetrated before", to assist in putting down the revolt of the native Maroons of the island.[1] Different again was the expedition of 1804 to the Surinam river in Dutch Guiana where one company of artillery accompanied a force of about 2,000, with twelve guns, from 3 to 12-pounders, eight 5½-inch howitzers and three mortars. The shortage of gunners implied there, it may be added, was almost universal in these West Indian expeditions. The largest and most successful efforts were those of 1809-10 against the French islands. Spain being now on the English side, one company of the regiment helped them to clear the French from St. Domingo; over three hundred accompanied the force of 10,000 men which finally secured Martinique after nearly two months' fighting and marching; a detachment rendered yeoman service in the capture of the island called The Saints. There followed the turn of Guadaloupe where in January 1810 three hundred artillerymen, increased to that number by fresh reinforcements from England, accompanied a force of 7000 strong. As it happened, however, the guns were used remarkably little. With its capture and that of one or two other smaller islands the fighting in the West Indies ceased and the artillerymen there must be left, doing garrison work in the seventeen places for which these had now to be provided. Whilst the artillery throughout these operations acquitted itself well, one company, then No. 8 Company of the 7th Battalion, emerged therefrom with a special distinction.

[1] Fortescue, iv. 464.

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Brought from Halifax N.S. for the Martinique enterprise they played their part with the greatest zeal and vigour. "In one day, this company prepared and armed a battery of six 24-pounders and four 10-inch mortars, and opened fire on the day following". For this and other services the company were specially rewarded being presented with a battle axe to carry with them as a company distinction, and acquiring thereby the name of the Battle Axe Company.[1]

The force sent under Craig on the first British expedition to the Cape in 1795 included no artillery at all from England. True, Craig obtained some from St. Helena and captured some, but though it eased his way to Cape Town and it was thought to be worth while to drag the guns by hand, the operations were neither serious nor protracted in their nature. Ten years later, however, two companies of artillery accompanied a force of over 6,000 strong under General Baird to the Cape, General Yorke who commanded the artillery being unhappily drowned on the way. The field guns, or some of them at least, having been landed with great difficulty, were used in the one engagement which took place, with effect enough to put to flight part of the Dutch force. But there was practically no other fighting and the heavier guns were not used at all. There was more serious work in the adventure which followed on the capture of the Cape, the expedition from there to South America. Manifestly unwise as it seems now, and equally certainly disastrous, it was yet another new field, almost a new continent, for artillerymen as for men of the other arms. But there was nothing so new in the fighting that we need give any consecutive account of the operations. To the original detachment of thirty six gunners who with four guns crossed from South Africa, there came in the next year reinforcements or, since the original force had by this time been taken prisoner, successors, one company and drivers with Auchmuty's force, two companies with Crauford's force and later still a battery of horse artillery. A sufficient supply of heavy guns was lacking for the siege of Monte Video, to some extent remedied by borrowing from the navy; and for the lighter guns there was the usual lack of horses. In the march to Buenos Ayres the guns stuck, as was to be expected, in the swampy ground, some of those captured from the Spanish having to be spiked and abandoned. In the decisive attack of July 5th on the town, though some of the many columns took light guns, 3 and 6-pounders, with them, the close fighting in narrow streets prevented their effective use in the advance to the centre of the town, but gave an advantage to the defenders whose guns had been posted to command the various approaches and squares. No less than thirty of these latter guns were captured by the British before the day's fighting, and with it the expedition, came to its inglorious but wholly natural end.

So far from having exhausted the work done by artillerymen during these years in the more distant theatres of the war, we have said nothing of it in India where though the fighting was neither so constant nor indeed so critical as in the earlier period, the services of the Bengal, Madras and Bombay artillery, not to mention those of the odd companies of the home regiment there, merit space out of all

[1] See Duncan, i. 418-19.

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proportion to that available and must again, therefore, go unrecorded here. Nor were their efforts confined to India. In 1810 they shared in the capture of Mauritius and in the next year, in company with some of the Royal Regiment, in the larger and more serious enterprise against Java, whose conquest saw what was for the time quite heavy though brief siege work, as well as cavalry pursuit with horse artillery.

* * * * * *

The Peninsular War presenting as it does far the longest and most important series of military operations conducted by the British during these years, best illustrates the use and development of artillery from 1808 to the end of the war. The good name of the regiment in and after 1815 was due to the work of the war in Spain and Portugal. The natural difficulties presented in the Peninsula to the movement of all arms, and not least to those of artillery, were indeed partly responsible for that development. It is perhaps usual to think most of the work of the horse artillery in the Peninsular and indeed it was there that the first Troops really found a field for themselves and covered themselves with honour. Yet it is probably true that the field artillery developed more in these years. There was more room for growth, not in size but in mobility, and that growth was undoubtedly stimulated by the horse artillery. None the less the creation of mobile field batteries appears to be, so far as artillery work is concerned, the most outstanding achievement of the Peninsular War, and every artilleryman to-day would agree that it was no mean one. The long campaigns of that war were of infinitely more value for the purpose than the shorter ones we have already mentioned, and did space allow, would be well worth following out in detail, even though a good deal of attention has already been given to the subject by artillerymen.

The main credit for the development of the field batteries must be given to the officers of artillery. It can hardly be given to Wellington who, as everyone knows, was primarily an infantry general and not specially appreciative of the value of artillery, though of course it would be foolish to suggest he was not alive to its utility. In the record of the war, the artillery probably suffered a little not by conscious intent but by natural omission, from the fact that the majority of its chroniclers, from Napier down, were infantrymen. Infantry observers, at any rate before the days of close barrage fire, were naturally more interested in the artillery fire of the enemy than in their own departing shot and shell, and so we hear more of the French artillery fire than we do of our own. It is true that the same reasoning gives the more weight to the words of a French observer like General Foy who was in a position to see the effects of the British gun fire. And of course the simple fact was that in the early part of the war at any rate the French had more guns. Not that the infantry observers were critical of their own artillery; they are almost universally flattering. But they naturally do not say a great deal of the fire effect of the guns. More information, though often of narrower range can sometimes be found in the journals or diaries of

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artillery officers such as those of Swabey, Dyneley, Bogue and others, in the letters of Frazer who commanded the horse artillery for the latter part of the war, and most important of all, in the materials left by the then Major and Colonel Dickson, who from the Portuguese artillery came to take the command of Wellington's artillery. From these we learn, what we are apt to forget, how much of these six years was spent in overcoming the difficulties of transport, supply of stores, of forage, in struggling not with the French but with the rudeness of nature in Spain or the sins of omission of the Board of Ordnance at home. Horses were short practically throughout the war though never so short as at its opening. Beyond the difficulty of meeting the increasing demand as the forces in the Peninsula grew, the mortality was naturally high when shelter was scarce, the country difficult and forage often insufficient. And the artillery naturally did not get the best of the horses. "Old, blind and casts from the cavalry" was Colonel Robe's description of those sent out to him in 1808. Oxen were used in the gun teams in the first campaign in that year, as for the siege train 1812. Mules were used throughout and on one occasion at least we hear of horses, mules and oxen in the same set of vehicles. Still matters undoubtedly improved in this regard as the war went on, both positively and comparatively with the French, whose horse-flesh to begin with was superior to that of the British in the Peninsula.

The comparatively low percentage of guns to men in Wellington's army was primarily due to lack of horses. Napoleon's increased appreciation of artillery, helped toward the later campaigns by his collosal losses in men, had brought an increase in the proportion of artillery used. Three guns per thousand men was the proportion supported by most authorities of the time including Napoleon himself. This was sometimes exceeded by the French armies as by the Allies in the 1814 campaign. In the Peninsula, however, Wellington never attained so high a figure; he was nearer one gun per thousand men and never in battle exceeded two. And the French, though they had a superiority in guns for most of the war, never reached there the proportions they attained elsewhere. They lost far more than the British, for example at Vittoria when they lost over 150, or when Soult abandoned the whole of his guns on his retreat in 1809. Wellington had less but lost far less, in fact it is one of the things of which the gunner is legitimately most proud that never in the field did the British artillery permanently lose a gun to the French through the whole war. Though Wellington, as the war went on, made efforts to increase both the weight and the amount of his artillery, a lesser amount of mobile artillery suited his method of forming his line of battle behind a ridge, as well as his long and strenuous marches. As Mr. Oman puts it,[1] "Wellington loved to show a position apparently but half defended, with his reserves, or even his main battle line, carefully hidden behind the crest, or covered by walls and hedges, or concealed in hollows and ravines. Hence the French artillery preparation was much embarrassed: there were no masses to fire at, and it was impossible to tell how any part of the line was held."

[1] Oman, Peninsular War, i, 121.

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The place of the artillery in Wellington's divisional organisation has already been mentioned. The guns in battle tended to be distributed in batteries with the different divisions, fighting advancing or retreating with them, though of course batteries or sections were moved about as occasion demanded. Wellington himself frequently placed guns as he wanted them, as for example at Bussaco when he brought up two guns to catch a French column in flank. It was indeed the exception rather than the rule for the guns to remain in one place through any one of the Peninsula battles, despite the defensive nature of most of the early ones. They did not always work by single batteries. At Bussaco, Wellington had more than one battery in front of the convent to meet the expected attack up the gulley; at Barrosa, Graham had his ten guns in line between his two wings as they advanced, though that was in part accident rather than arrangement; as early as Vimeiro 12 guns close together on Vimeiro hill helped to repel the main French attack and at Oporto, three batteries had been placed in line on the high ground south of the Douro to cover the crossing, much as was done four years later at the Bidassoa. In the fighting of the Pyrenees, batteries were grouped on several occasions to secure increased fire effect. The best example of the massing of guns for this purpose was, as is well known, that of Vittoria where most of the British artillery, which included by this time ninety guns, was massed against a superior number of French guns, the fire of eighty of which Napier has vividly described. This grouping however, effective as it was, came less from design than from circumstance. "The nature of the country and want of roads, was the means of throwing a large proportion of our artillery together", wrote Colonel Dickson who commanded it and was best qualified to know. It goes almost without saying that notwithstanding the fact that Wellington's battles, after Rolica, to Salamanca, were defensive, the artillery, so far as we know, was not entrenched in battle any more than the French guns were. The guns of position had gone with the battles of position.

The emphasis on mobility naturally meant that the horse artillery were in great demand, especially since they were not necessarily armed with a less effective gun than the field batteries. Wellington was so far from recognising any essential difference in armament that when Captain Webber Smith's troop came out at the beginning of 1813, the Duke ordered their 6-pounders to be exchanged for 9-pounders, though there were 6-pounder field batteries in existence. After Corunna, the first troop, Ross's, arrived up country just too late for the battle of Talavera, though they had marched 62 miles in 26 hours in full midsummer weather in their eagerness to be present at it. But they or their brethren, shared in practically every other battle of the war and shared fully: we cannot pretend to recount their services. At Fuentes D'Onore they specially distinguished themselves, checking the attempt of the French cavalry to get round the right wing of the British which was being drawn back to right angles of its first position, in which operation it was that Ramsay, with a section of Bull's troop, was caught and made the dashing escape which Napier has made immortal. But that was only one of many occasions. Not less notable and perhaps more characteristic was their work with the cavalry on the advance or retreat, that of Downman's troop on

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the retreat to Corruna, of Ross's troop at the combat of the Coa, of Ross's and Bull's troops in the pursuit after Massena in 1811, or in the retreat from Burgos in 1812, to go no further, though one is tempted to quote a good example from Swabey's diary,[1] for the work of his troop on one occasion in 1813. The work of what we may by anticipation call the field artillery, was of course no less useful if less dramatic. From what has been said it follows that we do not get as a rule great massed effects but rather the more modest efforts of detached batteries which were more likely to escape record and, since they occurred in every battle of the war, are beyond description here. Barrosa furnishes as good an example as any perhaps, of their work in action "Never", said Graham, who was in command of the British there, "was artillery better served". Ingilby's diary gives a good account of the work of his battery in the battle of Fuentes D'Onore.[2] Their importance, like their numbers, increased as the war went on, in part because for the first time they had a long and continuous series of field operations, and had found their real unit, the battery. Horse and field alike shared, as they did in battle, in the toils of campaigning. So far as the difficulties of marching were concerned, the latter part of the war saw an increase rather than a diminution as the Pyrenees were reached and finally crossed. Napier describes how in those mountains "neither the winter gullies, nor the ravines, nor the precipitous masses among the rocks, retarded the march even of the artillery; where horses could not draw, men hauled, when the wheels would not roll, the guns were let down or lifted up with ropes". The Chestnut troop, we learn, had its carriages shaken to pieces, so bad were the roads. These latter conditions were responsible for the use of what were practically mountain guns. Indeed the mountain artillery of to-day may be said to date its existence from the Pyrenees campaign. Three pounders had been used in the first campaign of the war, Lawson's battery of 3-pounders having rendered signal aid in the pursuit of Soult. Now, in 1813, the 3-pounder was again brought into use. Lieutenant Robe, son of Colonel Robe, was given three such guns capable of being carried on pack mules, and other batteries of three guns were likewise organised. They proved of considerable assistance, reaching and firing from places which were inaccesible to the heavier guns, as for example in the battle of Nivelle. Throughout the war Wellington had at his disposal the artillery of the King's German Legion, which practically formed part of the British artillery, sharing its work and its repute. There were also a number of batteries of Portuguese artillery to which British artillery officers were appointed, Colonel Dickson for a time commanding them. Their quality, indifferent at first, improved very markedly in the course of the war.

The sieges of the Peninsular War were not the happiest of Wellington's efforts. In fact one of them, the unsuccessful siege of Burgos, has been called "beyond all question the most unsatisfactory operation on Wellington's part during the whole of the Peninsular War".[3] The primary cause of the ineffectiveness of his siege opera-

[1] Min. Proc. R.A. Inst., xxii, 1895, p. 600.

[2] Ibid. xx, 1893, p. 24. The battery lost 18 out of 54 gunners and 25 out of 48 horses that day.

[3] Fortescue, viii, 583.

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tions was the lack, on the spot, of an adequate siege train. That apparently resulted less from lack of such a train than from the difficulty of getting it up country from Lisbon, for which purpose the Spanish rivers, in contrast to those of Flanders, were almost useless. Thus we find early Jacobean guns from Elvas being used for the 1811 sieges of Ciudad Rodrigo and Badajoz, and proving entirely unsatisfactory. The ox trains collected by Dickson with such pains were naturally almost intolerably slow in moving about. Wellington in addition, lacked engineers, as is well known. And it must be confessed that artillerymen had had little experience of offensive siege operations on any scale since Marlborough's day, whilst the absence of any specifically "siege" companies was, so far as sieges alone were concerned, necessarily a handicap. Further Wellington himself, as he confessed in the case of Burgos, was influenced by his Indian experience, where a speedy storm after battering old or mud walls had sufficed. Warfare in general, too, had quickened its pace and the Duke never had the unlimited time of earlier campaigns for his sieges. The task of the artillery in these sieges was to make a "practicable breach", in as short a time as possible, after which the infantry stormed. Omitting the brief attempts of 1811, the siege proper of Ciudad Rodrigo in January of the next year, lasted but five days. The cold dry weather assisted the besiegers who had thirty guns at the maximum, mostly 24-pounders though with some 18-pounders. Before Badajoz, two months later and in the spring rains, the actual breaching of the walls, with 36, 24 and 18-pounders and some howiters, began on the 30th March and the main breach was declared "practicable" by the 6th April, when the storm was made that was to prove it so fatally "impracticable". Napier has lit up the story of that storming for so long as the British Infantry endures. And, indeed, elsewhere, as at Badajoz, the main interest of the sieges save to the student of siegecraft, will always lie in the attempts to assault, successful or not. The siege train for Burgos, three 18-pounder and five 24-pound howitzers of uncertain origin and still more uncertain accuracy, was so utterly inadequate that it never made any serious impression on the place, the strength of whose defences had been much under-estimated. And ammunition was so short that Colonel Dickson had to rely to no small extent on the roundshot the French might be pleased to send over to him, which were carefully collected and returned, for aught we know several times. The siege of Pampeluna was carried on by the Spaniards though some British artillery took part in it. That of San Sebastian is of interest though not from any marked development in the conduct of the siege operations. The number of pieces employed was much larger in the second of its two sieges, which opened with a salvo of about fifty heavy guns and mortars. In both sieges the breaches were tried after five days firing, the second time with success. That success was facilitated by the additional help given by the guns during the actual assault, a matter of some interest to artillerymen. Since the assault showed some signs of failing as the first had done, the bold expedient was adopted of firing what was practically a barrage of forty-even pieces over the heads of the stormers to keep down the fire from inside the fortress. "The great body of our cannon", reported Colonel Dickson,

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"fired upon the great curtain and behind it over the heads of our own men (only a few feet perpendicular lower down) with a vigour and accuracy probably unprecedented in the annals of artillery." Obvious as such a method would seem now, it was sufficiently unprecedented then to call for great praise for the gunners at the time. We may perhaps see in the performance some evidence of the increasing accuracy and skill of the gunnery of the period after so long and stern a schooling as the Peninsular War provided.

* * * * * *

The short but highly dramatic campaign which followed in 1815 afforded further and more substantial evidence of the development of the artillery in the last seven years, both in manœuvre and action. Prepared and despatched on active service at short notice, added to by brigades which barely touched England on their way from the American War, the artillery in May earned the "unqualified approbation" of the Duke himself. This was the phrase used of a field brigade; the horse troops came in for even warmer praise. And, not forgetting the Duke's later criticism which need not be further referred to as it has been adequately dealt with elsewhere,[1] the part played by both horse and foot in the decisive battle was as important as it was creditable.

The outline and indeed the detail of the battle of Waterloo are so well known that there is the less need to do more than remark on some of the specifically artillery features of the day, without making any attempt at a general description. Part of the British artillery was of course engaged at the battle of Quatre Bras, two batteries well in front there being charged through and through by the French cavalry with the temporary loss of two guns for lack of horses to move them. But the fighting that day hardly compared with that of two days later. Wellington probably appreciating both Napoleon's use of artillery and the advantages which Flanders possessed over Spain for the employment of that arm, had made great efforts to raise the amount of artillery in his army. In part because of the great difficulty of securing enough artillery drivers for the field brigades, he asked for and obtained an increase in the horse troops, so much so that at Waterloo there were actually present and engaged eight troops of horse artillery to five brigades of field. One of the latter was attached to each of the five divisions as in the Peninsula, though a German battery was likewise allotted to each division. Sir George Wood commanded the Allied artillery but credit must be given to Sir A. Frazer, who, as before, commanded the horse artillery, for changing the armament of three of the horse troops from light 6 to 9-pounders in order to reduce the advantage the French enjoyed with their 8 and 12-pounders. Since all the field brigades had 9-pounders, save for three howitzers, this gave the British eight 9-pounder batteries, four light 6-pounder troops, and one troop of 5½" howitzers, a total of 78 British guns. To these must be added the King's German Legion, Hanoverian, Brunswickian and Dutch-

[1] Duncan, ii. App. B; Hime, History of the Royal Regiment of Artillery, 1815-53, p. 125.

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Belgian guns which made the total up to 156 guns to 68,000 men, two and a third guns per thousand, more than the Duke had ever had in the field before, though reflecting in its composition the composite nature of his army. Yet he was still considerably outnumbered in artillery, as in cavalry, by the French, for Napoleon to his 74,000 men had 246 guns, one gun more per thousand men than Wellington, many of them 12-pounders. The Prussian guns of course helped to redress the balance late in the day.

Wellington's position was a defensive one and the rôle of the artillery was correspondingly defensive until the close of the battle. The front line of guns was posted along or in front of the low crest which they "crowned" as Frazer saw it, one battery at least being well down the forward slope towards La Haye Sainte in the centre. Beyond the cannonading of the Napoleonic legions, the task of the guns was to weaken or check the force of the attack of the French infantry and cavalry as these advanced across the hollow which lay between the two armies and up the slope to the crest behind which lay the main portion of the Duke's infantry. The artillery was, in the early stages of the battle at least, denied the satisfaction of trying to keep down the heavy French artillery fire which poured into the British position, on to guns and infantry alike, from the great mass of the French guns. D'Erlon's attack was preceded by an artillery preparation of 1½ hours from ten batteries, 78 (or 74) guns in all firing at a range of less than half a mile. The successive cavalry charges of the next stage of the battle were prepared for in the same way by a concentration of French artillery fire on the allied right centre. And finally the advance of the Guard was heralded, though more briefly, in the same fashion. From these bombardments, which ceased only when the attacking waves had closed with the Allies, the artillery like the infantry suffered fairly heavily. Not a few guns were disabled and the losses in officers, men and horses were more severe than in any of the battles of the Peninsular War; Mercer's troop for example lost 140 out of 200 horses. Not that the allied guns suffered these successive bombardments and attacks to pass unanswered. If they lost more heavily than before they also fired more heavily, one battery (Sandham's) firing what was then the very large total of 1,100 rounds in the battle (rounshot, shrapnel, grape and canister). They frequently outran their supply of ammunition. Whilst it would be an exaggeration to call Waterloo an artilleryman's battle, and whilst Napoleon had employed his artillery with greater effect in some of his earlier battles, it is safe to say that never had so many British guns been served so hard or so long as they were on that summer day. A few batteries of heavier calibre than 9-pounders for counter battery work would have been invaluable.

Though it was for the Allies a defensive position and battle, in no case were the guns "dug in" in any way, though occasionally, as in one of Mercer's positions, some protection was received from the nature of the ground. Other protection would indeed have been of little use since many of the guns were moved about during the battle, from second to front line and from left to right as occasion demanded. When the attack on Hougomont developed, for instance, Bull's troop, armed with howitzers, was sent for and came up "handsomely" to drive the French out of the part of the wood which they had seized

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in front of the chateau. As the battle progressed and the weight of the French attack on the allied right centre i.e. to the west of the main high road, was felt, the British and allied guns became most concentrated there, "in masses" to quote Frazer again. Here they felt the full weight of the great cavalry charges. Time and again did the batteries of the front line see the French horsemen loom up out of the smoke, often at hardly more than a few yards distance. The orders were that the gunners, having emptied their guns on the advancing cavalry, were to take refuge in the infantry squares in front of and between which they were posted, and this is what normally happened; they continued firing case until the horsemen were almost on them and then took refuge in the squares, emerging again in time to catch the wave of receding horsemen as they withdrew baffled from the unbroken squares of the infantry. The French cavalry though they surged over and through the guns repeatedly, could neither spike them nor get them away, though some of the cavalry carried ropes with which to drag the guns away. Lloyd's field brigade, for example was charged through six or seven times by the cavalry in this way, but each time the tide receded and the guns came into action again. Not always did the gunners escape in this fashion; some were caught at the guns, others found hazardous refuge under their carriages, one battery at least, Mercer's, disregarded the orders to take refuge and fought their guns against the oncoming cavalry whom they almost literally blasted away from their muzzles. Whilst the front line guns thus bore the first brunt of the repeated cavalry charges, in the last great attack of the Imperial Guards the position of the major part of the British guns, more advanced on the right, gave them an evident advantage. Since this last attack was unsupported by infantry or cavalry on the (French) left, the guns of some of the British batteries were able to pour in what was almost a full flank fire on the head and columns of the advancing last hope of the Empire. How that final effort ended everyone knows. What guns were still able to move and could be horsed, took part in the general advance, but we need not attempt to follow them as they laboured across the battlefield and on towards Gemappe. The French guns which had shot so fiercely were there for the taking next day. The fighting was practically over; peace, reductions and stagnation if not more, were to follow. Not for another century were British guns to echo over Flemish fields.

The century of regimental life for the British artillery which was completed in this same year 1815 had been one of unparallelled military activity for the country. Not merely had there been the great and continued struggle with France which had sent armies and artillery as part of them, into almost every corner of the world, but as we have seen, there had been warlike enterprise, offensive and defensive far beyond that. No one with the memory of the last great war in mind—and who has not?—will advocate the desirability of war in order to develope or make efficient any arm of war. Yet it may be admitted without question that the position British artillery had attained by 1815, a position which has been a heritage to several generations of gunners down to our own day, was won on those hard and wide spread-battlefields of the 18th century, from the days of Marlborough to those of Wellington.

The End.

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TEMPORA MUTANTUR.

A reply to Captain Hilton's article under the above heading in the R.A. Journal for October, 1920.

By Capt. J. H. M. Stevenson, m.c., R.G.A.

At the present moment the service is faced with the problem of steering a middle course in the adjustment of its outlook between the two extremes of reaction and unnecessarily ruthless iconoclasm.

From some of the statements in Capt. Hilton's article, it appears that in his efforts to avoid Scylla he has become dangerously involved in Charybdis.

He says that, in savage warfare, the case in which the enemy possesses towns, villages, herds or other property may be dismissed at once, and the matter left to the R.A.F. "Artillery at any rate will not be required."

This scarcely seems to have been borne out by recent events in the North-West Frontier, though the work done in that quarter by the Royal Air Force has been invaluable, the mountain batteries could not have been omitted from the forces used.

In comparing machine guns with mountain guns for warfare in mountainous districts, Capt. Hilton says that the moral effect of machine guns is much greater than that of Mountain Artillery.

The views of some of the Pathans who have met both would be interesting, but they would hardly corroborate Capt. Hilton's.

"The material effect of machine guns at close ranges is very great," but they would be of little use for destroying frontier towers or sangars.

Modern developments in military material are without doubt very excellent, and if properly employed will prove of the greatest service to the forces employing them, but it is a pity that an officer should allow his mind to become so obsessed with them that he can refer to Mountain Artillery—a branch that he knows obviously little about—as "an out-of-date branch of the Regiment superseded by the progress of modern arms" and it is a still greater pity that he should air these views in an article which might mislead others who have had no acquaintance with Mountain Artillery.

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CONTENTS OF LEADING FOREIGN JOURNALS.

America.

Field Artillery Journal. Sept.—Oct. 1920.

Contains an interesting article on Ordnance Motor Equipment for Artillery Transport. By Major W. A. Capron. It deals with vehicles of the track-laying type, which constitute the cross-country Combat Transport of the Army. (17 photographs.)

France.

Revue d'Artillerie—November, 1920.

I. Study of an operation carried out by an Army Corps, Gén. Farsac. (Map).

In this article Gén. Farsac applies to a concrete case the organisation of the Artillery he recommended in his article on Organisation of Artillery in the Army Corps in the October number of this journal (reviewed in R.A. Journal. Vol. XLVII. No. 9 p. 453).

II. Concerning the Organisation of the Artillery in the Army Corps.

A criticism of Gén. Farsac's article.

III. Study of an operation carried out by an Army Corps with the actual organisation of the Artillery.

(The same manœuvre as in I. The only alteration being that artillery orders are given in accordance with "Service en Campagne de l'Artillerie"—June 1919.

The author concludes:—the actual advantage of the present organisation over that proposed is that each Divisional Commander has out of the six groups whose mission it is to support him *two* that he knows, is accustomed to, who know him and whose commanders are constantly under his orders.

In the preparation and execution of his task he knows he has two commanders on whom he can rely to understand him quickly and to carry out any difficult job without delay or misunderstanding.

IV. Graphic Range tables. Lieut. Spoerry.

V. Physical training in the Artillery.

VI. German and Austrian High Power Guns. (Continued.)

Revue Militaire Générale

I. Remodelling of regulations and our war teaching. Lucius.

II. Transportation by rail of the American Army in France (1917-1919). Lt.-Col. Andriot. (To be continued.)

III. Notes on Aerial warfare in front of Nancy. Capt. P. Weiss.

IV. Notes from Upper Silesia.

V. Review of "Mon Rapport sur la Bataille de la Marne," de von Bülow. Jean Bigorre.

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Belgium.

Bulletin Belge des Sciences Militaires—December 1920.

I. Operations of the Belgian Army 7th, 8th and 9th October 1914.

II. The strategic importance of Dutch Limburg and the defence of the Meuse. Lt.-Col. d'E. M. Nuyten. (To be continued.)

III. Physical Training. Lt.-Col. Grade.

IV. Belgian Strategic Railways during the war 1914-1918. Major A. E. M. Denis. (Continued.)

V. Outposts in battle. Major d'E. M. Requette.

VI. Notes on foreign Armies.

Germany. (a) A new law dated August 21st, 1920, does away with obligatory Military Service.

(b) Reduction of the Army to 150,000—

(1) Reichswehr 100,000. 7 Infantry Divisions. 3 Cavalry Divisions.

(2) 3 Mixed Brigades 28,000 (temporary Army).

(3) Various units of temporary Army 20,000 (2) and (3) should be disbanded by 1st January, 1921, when the army will not be permitted to exceed 100,000.

(c) The organisation of the new police is taking place. At present the "protective" police is on a military basis.

(d) Disarmament of citizen Guards. Formations still exist in great numbers. In Bavaria the 'Orgesch' enjoys Government support. In the other States citizen guards are officially forbidden.

(e) General disarmament. Armament destroyed. Aerial material accounted for or destroyed. Arms handed in by civilians, etc.

Amongst books reviewed is: La juste paix par Levy. Paris, Plon: 1920.

The author goes into the finance and economies of the Peace Treaty. His theory is "Germany can and ought to pay". To establish his reasoning he condemns Keynes "Economic consequence of the Peace".

Switzerland.

Revue Militaire Suisse.

I. Military Ski racing. Col. Grosselin.

II. Indirect fire from machine guns. Capt. Monod.

III. Some notes on the Swiss Air Force during Mobilization. (Continued.) Lt. Quinclet.

IV. Diseases of the Circulatory System amongst the soldiers of the belligerent armies.

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V. Notes and news.

(a) The work of the Swiss Societé de Surveillance economique during the war.

(b) Tactical doctrine. Principles to teach in schools and courses in 1920 for the preparation of battle have been issued—based on German Doctrine. The writer advocates considering other nations instructions particularly the French and wants an elastic teaching, not a 'set piece' policy taken from the German experiences of the late war.

The French special correspondent writes on the work of the French Army in Morocco.

The American correspondent on the new organisation of the American Army.

GIFTS AND PURCHASES DURING THE MONTHS OF NOVEMBER & DECEMBER, 1920.

Books Presented.

By The Secretary, War Office.

Gun Drill for 4·5-inch Q.F. Howitzer, Marks I & II. Carriage, Mk. I. 1920.

Examination of Officers for Promotion held in October, 1920.

Handbook of the 2·75-inch B.L. Gun. Mule Equipment. 1920.

Notes on Electricity and Service Electrical Apparatus. Prepared by The Ordnance College. 1920.

By Brig.-Genl. G. D. Fanshawe, late R.A.

Histoire des Campagnes de Hohenlinden et de Marenge. Par M. de Bulow. Map. 8vo. London, 1831.

By The Secretary, Institution of Civil Engineers.

Minutes of Proceedings of the Institution of Civil Engineers, Vol. 206. 1917-18. Part II. 1920.

Books Purchased.

The Royal Artillery War Commemoration Book. A Regimental Record written and illustrated for the most part by Artillerymen while serving in the line during the Great War. London (Bell & Son) 1920.

My ·75. Reminiscences of a Gunner of a ·75$^{m/m}$ Battery in 1914. By Paul Lintier. Eng. Trans. London (Heinemann) 1917.

Forty Days in 1914. By Major-Genl. Sir F. Maurice. (2nd Edition). London (Constable) 1920.

L'Artillerie de Campagne dans la Guerre actuelle 75 &90. Par le General Dubois. Paris (L. Fournier) 1916.

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"DUNCAN" GOLD MEDAL COMPETITION, SUBJECT FOR 1920-21.

The Subject approved for the "Duncan" Gold Medal Prize Essay 1920-21, is as follows:—

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for horse draught, both on the road and across country."

The Rules for the Essays now read:—

The Annual Gold Medal, when awarded, to be accompanied by an *honorarium* of £20; the Silver Medal by an *honorarium* of £10.

The subject will be a Field (including Horse) Artillery subject one year and a Garrison (including Mountain) Artillery one the next year.

The candidates must be Officers of the Regiment who are members of the R.A. Institution.

Officers of the R.H.A. and R.F.A. will be allowed to compete for the Garrison Artillery subject, and Officers of the R.G.A. for the Field Artillery subject.

Officers are requested to confine their Essays to about 16 printed pages of "The Journal of the Royal Artillery." other things being equal, brevity will count towards success.

The Essays must be forwarded to the Secretary so as to reach him on or before the 1st of April, 1921, they should be marked "Duncan Essay" on the outside of the cover which should be sealed.

Each Essay must be type-written in triplicate. The Essays must be strictly anonymous, but each to have a motto, and be accompanied by a sealed envelope with the motto written outside and the name of the writer inside. Only one of these sealed envelopes is required for each set of Essays not three.

Further, if the writer wishes to recover from the Committee part of the cost of typewriting his Essay he should state this fact in the same sealed envelope, and write outside it, above the motto, "To be opened." All the envelopes thus marked will be opened by the Secretary after the result of the competition has been announced, and he will send the writers the money for their type-writing expenses. The Committee will allow a sum of £1 for type-writing each Essay.

The prize Essays and those commended become absolutely the property of the R.A.I. and cannot be published by the author without the sanction of the Committee. The remaining Essays, if applied for, will be returned, and can be used by their authors.

The Essays will be submitted for decision to three Judges chosen by the Committee.

The Judges are empowered to recommend:—

1.—That two Medals, one Gold and one Silver, be awarded, or

2.—That only one Medal, Gold or Silver, according to the merit of the Essay, be awarded, or,

3.—That no Medal be awarded.

The names of the successful candidates will be announced at the Annual Meeting, and Medalists will be distinguished as such in all Lists, &c., issued from the Institution, and in the event of a University man gaining a Medal, a report of his success will be made to the University of which he may be a member.

The Gold and Silver Medal Essays will be printed and circulated to members by the Institution.

If there are any Essays which do not gain a Medal but are commended by the Judges, it will be at the discretion of the Committee to publish them or not as they think fit.

N.B.—The Committee draw particular attention to the paragraph in the Rules above on the subject of length of Essays; a page of the "Journal" is roughly 550 words.

SUBJECT FOR 1921-22.

Officers who have any suggestion as to a suitable subject for the "Duncan" Medal Essay competition for 1921-22, should send the same to the Secretary, R.A. Institution, before the 1st April, 1921.

The subject for the year in question should refer to Garrison Artillery.

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Authors are alone responsible for facts and opinions expressed in their papers.

NOTICE TO AUTHORS.

Authors of papers are particularly requested to make their communications as concise as possible, and to present them in such a form that no substantial alterations to proofs will be required. All authors corrections must be made on their first proof.

Maps, diagrams or other illustrations accompanying Papers should be sent in in a state suitable for direct photographic reproduction. It is preferable that diagrams should be drawn on a larger scale than required, in Indian ink on white paper, all lines, etc., being sufficiently bold to bear the reduction required.

Any lettering should be written in pencil, that it may be re-drawn to the proper scale.

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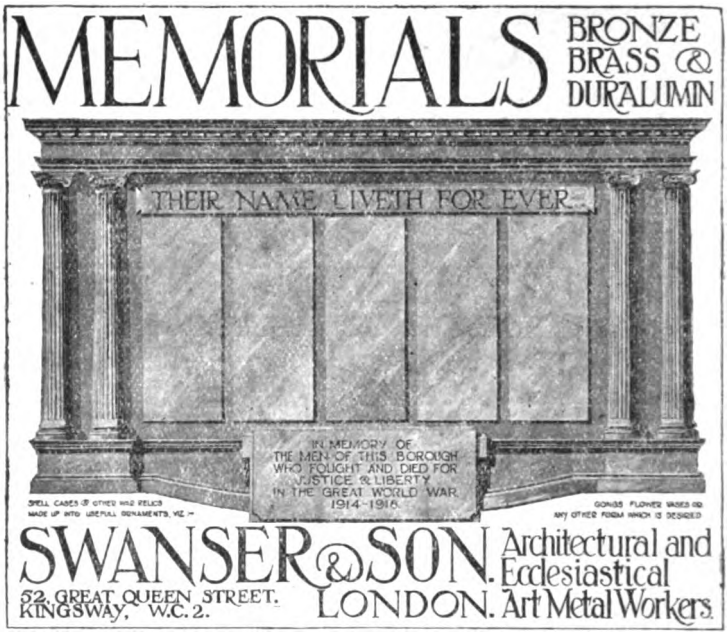

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"DUNCAN" COMMENDED ESSAY, 1919-20.

"The Reorganisation of the Royal Regiment of Artillery with a view to obtaining in war the best value from modern equipments with a minimum of expenditure of human energy."

By Major R. F. Lock, R.G.A.

MOTTO: "UNITY IS STRENGTH."

To re-organize: To form anew in due order.
To re-organize: So to arrange anew the parts that the whole shall act as one body.

HERE are two definitions taken from different dictionaries; to a very great extent they convey what is intended by the word "Re-organization."

Before consideration of the formation in due order and the arrangement of the parts of the Regiment it might be advisable to tabulate the modern equipments from which it is desired to obtain best value; but to do so might infringe the rule as to the length of this essay, so many and so various are the equipments produced of recent years.

To obtain a minimum of human energy it is essential that the varieties of equipments should be reduced and that those which are selected for retention should be standardized.

At first sight it may appear an absurd proposal to spend money on equipments now when so much is surplus to our requirements in the immediate future; but the cost would be quickly repaid in the direct savings on storekeeping, provision of spare parts and supply of ammunition, and the indirect saving in time on training is incalculable: it is one step towards attaining the minimum of human energy.

It is not intended that standardization should limit the Regiment to too few different equipments, but it is suggested that the Regiment should say "We want the following equipments for our post-war army, and we must have these equipments on the same general principles, we have no use for equipments of which only a few exist and we want to ensure that when a man goes to a new battery he will not have to learn all over again the equipment of his new battery because for example it has a different type of firing mechanism to that to which he is accustomed."

From equipments turn to transport. War Establishments of 1914 legislated only for horses for Horse, Field, Heavy and Siege Batteries and ammunition columns.

The next four years saw the introduction of many varieties of mechanical transport.

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The next forty years will see great developments in mechanical traction, in electrical, chemical and metallurgical knowledge and in the science of aviation.

The Gunner of the early part of the nineteenth century would have been amazed could he but have seen the Artillery of 1918, but he would have recognized his own regiment.

The Artillery of 1960 may be totally different. It may be a fantasy of the imagination, but it is conceivable that the Gunner of 1960 may have no guns; his duty in action may be to launch electrically propelled cylinders which while in flight are filled with some nitrogenous explosive and are directed by wireless.

It may be a fantasy but it is inserted to impress the fact that any scheme of re-organization must take into account the necessity for keeping abreast of scientific progress, and must allow for that progress being made use of by the Regiment for its own special needs.

To obtain in war the best value from modern equipments with a minimum of human energy it is essential that all ranks should spend part of their early service in a unit at war establishment.

It may sound wasteful and extravagant to suggest that any units in peace time should be maintained at War Establishment, but a few months in a unit at War Establishment are worth more in training than years of make believe in lower Establishment Batteries.

If all ranks have at some time served in a War Establishment Battery they fall into their places far more easily on mobilization and there is no waste of energy in then acquiring knowledge which could have been imparted in peace.

When attempting to minimise human energy it is not intended to reduce properly directed human energy but to formulate plans to save ill spent or mis-directed human energy.

Although this essay has to endeavour to show how to obtain in war the best value with the minimum of human energy, it is certain that in peace the best value must be sought with the minimum expenditure of money. The nation has raised the pay of all ranks to rates which compare well with other professions and trades, so it is certain and only fair that the Army of the future must work to really earn its pay and that there should be no place for those who cannot and will not work.

The day has passed, or should have passed, when the moderately well-behaved "passenger" may count on getting through his Regimental career just as well as the hard worker.

The Gunners' Creed mentioned three Artilleries; present-day conditions have increased that number to nine. They are:—

Horse Artillery.
Field Artillery.
Mountain Artillery.
Heavy Artillery.
Siege Artillery.
Coast Defence Artillery.
Anti-aircraft Artillery.
Trench Warfare Artillery.
Artillery on Railway Mountings.

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But these nine do not represent hard and fast divisions. Horse Artillery has acted as Field Artillery, Field and Mountain Artillery have had guns detailed for Trench Warfare work, Heavy Artillery have been almost Field Artillery, Siege Artillery has been wrongly named and parts have been akin to Heavy Artillery, Coast Defence has produced personnel for every branch and guns for Railway Artillery.

Yet there are still individuals who raise objections to the Amalgamation of the Regiment.

By hard work officers and men can be trained to be thoroughly scientific and practical gunners, and to be a good gunner now and in the future a thorough knowledge of working with all arms is a *sine qua non*.

The Re-organization of the Regiment must be on lines to ensure that all ranks can and do have opportunities of mastering all branches of their profession.

Some men are naturally better horse-masters, some are mathematicians, some are scientists; there is room for all but no room for the man who has no ambition to be an expert in any subject.

In addition to being an expert he must be well grounded, and keep up his general Artillery knowledge.

This is not an essay on training, but organization must be made to suit training and mobilization.

Training can be considered under two headings—individual and collective.

Successful mobilization demands speedy and economical despatch of the requisite units and reinforcements (personnel, animal and material) to meet the needs of the operations contemplated.

The organization of the Regiment has to be framed to give facilities for thorough individual and collective training of all ranks; and it has to be elastic to permit rapid expansion to meet demands for partial or complete mobilization.

It is proposed now to consider the organization for the Regular Army and thereafter to discuss the possible arrangements for the Territorial Army, the Army in India, and the Forces of the Dominions and Colonies.

The chart shown at the end of this essay is a summary of the proposals now put forward and shows briefly the manner in which it is suggested that the Regiment should be organized. The following pages are intended to explain the system in detail.

The system proposed only deals with Batteries, Schools of Instruction and the Depot.

The higher organizations are not mentioned as their organization must depend on that of other arms.

It is assumed that Batteries will be organized in Brigades of four Batteries and a Brigade Ammunition Column (except Anti-aircraft, Coast Defence and Guns on Railway Mountings).

Divisional Ammunition Columns of the future may reasonably be expected to have nothing but mechanical transport and if the equipments of the future are simplified and standardized so little technical knowledge will be necessary that the supply of ammunition up to as far as Brigade Ammunition Columns might be allotted to the Royal Army Service Corps and Royal Army Ordnance Corps.

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Organization for Individual Training.

There are two main divisions for the officer and soldier:—Elementary Training prior to joining a unit; Advanced Training.

The Elementary Training of the Officer will take place before he actually joins the Regiment and so is probably outside the scope of this essay. It will take place at the Royal Military Academy or at an Officer's Cadet School.

Officers must on joining the Regiment know as much about their duties as the young soldier when he leaves the Depôt and in addition they must have had a thorough educational grounding in general military knowledge.

Elementary Training of the soldier.—The young soldier starts his military career as a recruit at a depôt.

It seems a sound policy to group all the depôts for all branches of the Regiment at one station.

That the station selected should be Woolwich is a matter for rejoicing or regret as its advantages and disadvantages are viewed, but as Woolwich is selected it is better to make the most of the advantages and to endeavour to combat the disadvantages.

For individual training Woolwich can be organized as an excellent depôt.

Riding schools, lecture rooms, workshops and a theatre exist, there are plenty of Institutes and sufficient accommodation to allow for expansion.

The disadvantage of lack of training ground is not important if individual training only is carried out there.

Its old reputation of being a bad place for young soldiers can be outlived if the young soldier is provided with healthy, interesting and plentiful work and recreation.

When the depôts are grouped at Woolwich they must be reorganized; instead of having one or more depôts for each branch of the Regiment there must be one depôt divided into sections to suit the progress of the recruit.

The organization should in a way be approximate to that of a public school with its preparatory, junior, and senior schools and with instructors to specialize in the subjects which the recruit has to master.

By this organization the recruit will be better looked after, better taught and more quickly and more suitably posted to the branch for which he is considered best fitted.

This organization is suitable for expansion on mobilization.

The Depôt Administrative and Instructional Staffs would be specialists and any individual who has done a tour of duty at the depôt would be capable of carrying on his own speciality if recalled to the depôt in case of emergency.

The system of training evolved would lend itself to speeding up in case of emergency so that with an increase of administrative and instructional staffs recruits in large numbers could pass out of the depôt quickly and with sound individual training.

What is the recruit to know by the time he leaves the depôt and have finished his elementary training prior to joining a unit?

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He must know his dismounted drill, and standing gun drill, he must be grounded in map reading, signalling and range finding, he must have fired his musketry course. In addition, if selected for horse drawn batteries he must have passed through a riding and driving course and learnt to groom a horse and take care of his harness.

If selected for mechanically drawn batteries he will have passed through a mechanical course and would be capable of driving a lorry or a tractor or transporter.

Unless selected for anti-aircraft or a gun on railway mountings he would also have passed through a short course of gunnery.

Advanced Individual Training, all ranks.

The advanced individual training for officers and other ranks should also take place at Woolwich, and at the schools of gunnery.

Just as the depôt has been likened to the Public School so the Artillery College should be likened to a University where any subject may be studied with every facility for the prosecution of studies to the most advanced standard.

At Woolwich there is already an Artillery College; its proximity to London makes it easy to obtain the best lecturers on all subjects.

The Arsenal in peace time has ample accommodation for those who specialize in mechanics.

It is true that in war the Arsenal machinery would be otherwise employed, but by direct enlistment of trained mechanics there would be less need for machinery on which to train them.

At the Artillery College Staff Officers R.A.S.C. and R.A.O.C. would receive instructions in Ammunition Supply.

Collective Training, all ranks.

During the whole of his depôt training the recruit has been lectured on and seen (on the cinematograph) the various phases of the duties of the units for which he was being trained.

The ultimate object of his training is to make him an efficient member of a unit at war establishment so when he leaves the depôt he is posted to a battery at war establishment.

Men selected for anti-aircraft batteries and guns on railway mountings or leaving the Depôt, proceed to the Anti-aircraft and Coast Defence School where war conditions for those special branches will be studied.

Anti-aircraft Batteries, Guns on Railway Mountings and Coast Defence are made the exception throughout, as they differ from other branches in not having the necessity for manœuvre.

Their gunnery is the main object, and by combining Anti-aircraft and Coast Defence into one school to thoroughly train in the organization and gunnery necessary a nucleus is provided of specialists for defended ports at home and overseas.

All other recruits when they leave the depôt go to War Establishment Batteries.

The additional cost of the minimum number of batteries it is necessary to maintain at War Establishment to ensure that every young officer and soldier shall do a period of service in one can be

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more than saved by having a very much reduced establishment for the remaining batteries at home.

On mobilization these skeleton batteries would be made up from reservists who would be familiar with a Battery at War Establishment and would quickly "find themselves."

The War Establishment Batteries would only receive recruits from the Depôt twice a year, and the recruit would spend 6 months in the battery.

This entails the provision of at least six batteries at war establishment if there is to be a monthly passing out of recruits from the Depôt.

In the case of Horse and Mountain Artillery the reduced number of batteries in the regiment would not allow of six war establishment batteries each, and recruits selected for these branches would only in peace pass from the depôt twice a year to the one War Establishment Horse Artillery Battery or to the one War Establishment Mountain Battery.

From a War Establishment Battery the by now trained soldier passes to a skeleton battery at home, the whole of the rank and file for a skeleton battery being posted in one draft.

The establishment of a skeleton battery should be a definite fraction of a War Establishment Battery, so that in case of emergency, without mobilization, the necessary number of skeleton batteries could be amalgamated to form one battery, leaving the necessary cadre only for care and maintenance of batteries temporarily robbed of men and animals.

The skeleton batteries would pass on their men as a whole to batteries abroad.

War Establishment Batteries would pick out men for promotion and the particularly promising young soldier on leaving these batteries would find himself an N.C.O. for a skeleton battery or selected for advanced individual training.

Batteries abroad must have the same War Establishment as those at home but their peace establishment must vary according to the station. Whatever establishment it is it should be fractional of War Establishment so that as in the case of skeleton batteries at home amalgamation of two or more batteries could be arranged to form a War Establishment Battery. The personnel sent *en bloc* from a skeleton battery at home should whenever possible be kept together in a battery abroad and every soldier should go abroad when he has two years' service except those few specially selected for advanced individual training; but because a man has been sent abroad he should not feel he has lost the chance of advanced individual training.

After two years abroad a man should be eligible, if recommended and suitable, for return home to undergo special training.

When any man has finished his advanced individual training he will be required for depôt work, for War Establishment Batteries, for a School of Gunnery, or for extra Regimental Employment.

Any man not selected while abroad for advanced individual training will on return from abroad pass to a War Establishment Battery and later to a skeleton battery again.

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The War Establishment Batteries will thus have a combination of seasoned and of young soldiers and should be in a position to be able to profit by collective training with other arms.

For this training it seems essential that other arms should follow the same organization as is suggested for the Regiment, i.e., some units at War Establishment, others at skeleton establishment.

For Infantry this may be difficult since most regiments have only two battalions with the battalion abroad usually the stronger, but it might be arranged for war establishment training purposes to group two battalions to form one War Establishment Battalion.

Officers.

The organization to suit collective training so far has been mostly in reference to other ranks.

Young officers on 1st appointments will join War Establishment Batteries at home as supernumerary officers.

After six months they will be posted to batteries abroad and will not be posted to skeleton batteries at home until they are experienced.

After their first tour of service abroad officers will undergo advanced individual training courses and every officer will be encouraged to specialize if he desires to do so.

Thereafter officers will return to a War Establishment Battery, a skeleton battery, the depôt, a battery abroad or to special employment, or to coast defence and anti-aircraft.

After each tour of service otherwise than in a War Establishment Battery an officer will pass through one again to be brought up to date in his duties. Officers selected for Coast Defences will also do an Annual Course with the Siege Battery in the station at which they are doing coast defence duty.

The preceding pages have dealt with the organization to meet training requirements; it must now be considered from the mobilization point of view.

Will the organization as suggested permit speedy and economical despatch of units and reinforcements in war?

For a small war it has been suggested that batteries, if organized on a fractional establishment, can be amalgamated to produce war establishment batteries.

For a war which has necessitated reservists being called up it has been stated that the reservists would join skeleton batteries. It should be possible in most cases to allot each man to the last skeleton battery in which he served prior to transfer to the reserve and for that battery to hold his personal equipment and clothing. Batteries would then be formed of serving soldiers (either young or seasoned) recently transferred from a War Establishment Battery and reservists to whom that battery is more than a number and who probably know a good many other reservists who join it.

Reinforcements would be sent straight from the home War Establishment Batteries. They would not be drained dry as their intake from the depôt would be increased, and the course in the War Establishment Battery would be speeded up and more strenuous.

Animal reinforcements, to bring up and keep up the establishment of skeleton batteries would be carried out by the Remount

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Service, and War Establishment Batteries would be left alone in that respect.

Skeleton batteries would keep their complete war outfit of material and reinforcements would be made from Ordnance.

To meet a larger expansion than can be given by the skeleton batteries alone cadre batteries should be affiliated to skeleton batteries and surplus reservists should bring these up to skeleton batteries when the skeleton battery is mobilized. These cadre batteries would also hold complete equipment.

Skeleton batteries will each have a section of a Brigade Ammunition Column which will mobilize as the battery does.

Anti-Aircraft Batteries, Guns on Railway Mountings. Coast Defence.

The organization outlined in the preceding pages is not applicable to Anti-aircraft Batteries, Guns on Railway Mountings and Coast Defence.

Anti-aircraft Batteries and Coast Defence at home should be manned entirely by Territorial Artillery provided there are experts to keep equipments efficient and to impart instruction.

Abroad there are few sources from which suitable fighting personnel can be obtained locally and if Coast Defences are to be maintained to provide for even a few guns to be manned Regular personnel must be provided, as Coast Defences may have to be mobilized without delay.

It is nevertheless feasible to provide Territorials at home earmarked to proceed to definite coast defences abroad, each home port having an affiliated port overseas, provided again that there are experts to keep equipments efficient and to impart instructions. The guns of the affiliated port should whenever possible be the same nature as those in the home port.

Regular personnel selected at the depôt for Anti-aircraft, Coast Defences and Guns on Railway Mountings would be thoroughly trained at the school of instruction which should be located at a coast fortress. Officers will join the School of Gunnery if selected for Coast Defence and Anti-aircraft after their first tour of duty with a battery abroad. After passing through their course men would be distributed to ports at home and abroad.

Those at home would be available to act as district gunners and to help with the instruction of Territorial Artillery. Those abroad would also act as district gunners and as P.F. specialists, telephonists, Fire Commander's staff, etc., the remainder of the personnel for manning the defences abroad being found from siege batteries stationed at the port.

These siege batteries could without any lack of efficiency (remembering that all ranks in future have to work hard) maintain their own battery and the Coast Defence and Anti-aircraft guns to which they are allotted.

On the arrival of Territorials, the siege battery could be withdrawn as a whole, for the Territorials would be familiar with the nature of gun they had to man, and the expert Coast Defence and Anti-aircraft personnel would not be withdrawn.

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Guns on railway mountings presumably would all be kept at home in peace and would be manned by Territorials who would proceed with them to the theatre of war.

The expert nucleus would be required for training further batteries, or to provide for mobile anti-aircraft batteries if these were not entirely Territorial.

Trench Warfare Artillery has not been considered; the evolution of Field Artillery and of the Machine Gun Sections of Infantry will cause this part of the Regiment to disappear.

Territorial Artillery. The Army in India and the Forces of the Dominions and Colonies.

The Territorial Artillery will have to provide for Coast Defences and Anti-Aircraft Batteries and Guns on Railway Mountings as indicated above, both for home ports and ports overseas, and will need to have 225% establishment. Besides this the Territorial Artillery will have to provide Horse, Field, Heavy, Mountain and Siege Artillery for the Territorial Army. The first essential is that in the Territorial Army (and the same remarks applies to the Army in India and the Forces in the Dominions and Colonies) the war establishments and equipments shall be identical with those for the Regular Army.

Territorial Artillery should be in a position to be always at or above war establishment, and the Territorial battery will have to combine the training given to the Regular soldier in the depôt and in the War Establishment Battery. Territorials should be encouraged to go to courses at the depôt and at the Artillery College on any special subject and the depôt should lend instructors to tour and teach Territorials. Territorials should have every opportunity of visiting Regular War Establishment Batteries.

Territorial feeling is said to be so opposed to merging with Regulars that it is difficult to suggest a satisfactory method for adequate organization for the supply of reinforcements.

It is essential that the recruit should have a working knowledge of a battery at War Establishment, and the probably best solution would be for County Associations to combine to form Reserve War Establishment Batteries, by keeping a nucleus from serving Territorials and completing the first line batteries from Territorial Reservists.

The Army in India will consist of trained regular soldiers supplemented by native drivers who should be trained in the batteries. British residents in the large coast towns should be able to provide the personnel to man the local coast defences.

The Forces in the Dominions and Colonies could follow the same procedure as indicated for the Regular Army at home for their permanent forces, and their Territorial forces could act as the Territorial forces at home, though if there is no local prejudice it would be a simplification if Territorials after mobilization trained with Regular recruits.

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It has been stated that mechanical training will be given at the depôt, and that specially selected men will go to advanced individual training direct from War Establishment Batteries, and that officers will be selected for advanced individual training.

The motto of the author is "Unity is Strength." In the past the Regiment has had intimately connected with it R.A.O.C. providing inspectors of ordnance machinery and armament artificers, R.A.S.C. providing drivers for batteries with mechanical transport, R.E. for signals.

The one big depôt system and the War Establishment Batteries coupled with an Artillery College to provide advanced training should enable the Regiment to be self-contained, and to leave the R.A.O.C. to the provision of ordnance Stores, the R.A.S.C. to the provision and supply services, and the R.E. Signal Service to provide for higher formations.

Armament artificers can be trained at the depôt and at the Artillery College from gunner recruits men and boys.

Officers to perform the duties of inspectors of ordnance machinery can be selected and trained and would far more appreciate the battery officers' view than officers who must be primarily mechanical engineers and secondly belong to another corps.

Is it conceivable that drivers in Horse or Field batteries should be provided by the Royal Army Service Corps when those batteries are horsed?

It does not seem necessary to argue that the drivers of mechanically propelled vehicles used for artillery work in a Lieut.-Colonel's command must belong to the Regiment: the fact seems self-evident.

This is the Regiment re-organized, with one depôt, war establishment batteries to provide adequate training, skeleton and cadre batteries to be filled on mobilization with properly trained men, and above all independent of other corps.

Assuming seven years' colour service and 5 years' reserve service, a man will spend his seven years normally as follows:—

Nine months	...	Depôt and Gunnery School.
Six months	...	War Establishment Battery.
One month	...	Leave.
Six months	...	Skeleton Battery.
One month	...	Embarkation leave.
Four years	...	Abroad.
One month	...	Disembarkation leave.
Six months	...	War Establishment Battery.
Six months	...	Skeleton Battery.

It is thought that this will give him efficient time for training and that by spending the last year of his service at home he will be brought up to date in his knowledge and at the same time have opportunities of finding employment when he leaves the Colours.

It may cost more to only keep a man abroad four years, but it's long enough without leave and in surroundings that have not the same attraction that they have for the officer.

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There may be criticism at batteries at home being kept at home and those abroad being kept abroad, but after all batteries have changed and been absorbed and re-created so often that if *esprit de corps* is fostered at the depôt the men will cling to the battery they are in because they are gunners.

It is better to play for the Regiment than for the battery. The Regiment is bound to move with the times and to be reorganized again and again as science advances, so now when re-organization is due let it be on regimental lines, and let everyone remember that he is a gunner first, whether he rides a horse or a motor-bicycle.

Human energy must be reduced to a minimum in future wars. By efficient training in peace, by constant application of progress in science to our Regimental needs, by standardization of equipments, by hard work on the part of all gunners of all ranks the Regiment will be able to give the best value to the Nation in war in the future.

[For Chart see next page.]

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IN PEACE.		ON MOBILIZATION.			
UNIT	PERSONNEL	PERSONNEL SENT TO	DUTY	RE-INFORCEMENTS	REMARKS.
Depôt	Instructional and Administrative Staffs Recruits.	War Establishment Battery	Continues to train recruits	— — —	School of Gunnery for Branches on a Battery organisation is attached to Depot.
Artillery College	Instructional Staffs Students (officers and other ranks)	As required on termination of studies.	Continues to provide instruction.	— — —	
War Establishment Battery	Young officers (supernumerary) Young Soldiers Trained Officers Trained Soldiers after tour abroad	Abroad Skeleton Battery as required Skeleton Battery	Continues to pass out trained officers and soldiers.		
Skeleton Battery with Cadre Battery and Section of Brigade Ammunition Column attached.	Officers who have served abroad Soldiers after first tour in a War Estatablishment Battery Soldiers after subsequent tour in a War Establishment Battery.	Batteries Abroad Reserve	Brought up to War Establishment by Reservists.	From War Establishment Batteries.	
Batteries Abroad.	Senior Officers Young Officers from War Establishment Batteries at home. Soldiers from Skeleton Batteries at home.	As Required Artillery College War Establishment Battery at home	Partial by amalgamation with other Batteries Complete by drafts from home.	From War Establishment Batteries.	

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UNIT	PERSONNEL	PERSONNEL SENT TO	DUTY	RE-INFORCEMENTS	REMARKS
School for Anti-Aircraft, Coast Defence and Guns on Railway Mountings.	Specially selected officers from Artillery College. Specially selected men from Depot.	Coast defences home and abroad	Training continues	— — — —	
Coast Defences home	Officers.	To War Establishment Batteries at end of tour.	To Anti-aircraft or remain with Coast Defences.		
	Specially selected men from School	To Coast Defences abroad as necessary			
	Territorials.	.....	Half proceed to affiliated port abroad.		
Coast Defences abroad	Officers	To War Establishment Battery at end of tour.	Remain with Coast Defences and Anti-aircraft.		
	Specially selected men	To Coast Defences at home as necessary.			
	Siege Battery	.....	To Theatre of War when relieved by Territorials.		

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PORTABLE GUNS.

By Capt. J. Price, R.G.A.

GIVEN time and labour any gun can be taken anywhere, either by making roads or by sheer hauling. But time and labour being scarce commodities in war, special portable guns have been evolved to give independence of roads.

Under the name of Portable Guns it is proposed to discuss all guns designed to be carried on occasions by man power.

HISTORY.

During the last century the chief man-killing projectile was shrapnel, common shell being reserved for the destruction of materiel. Shrapnel for its effect must have sufficient remaining velocity and hence the man-killing weapon was a gun of flat trajectory.

The mountain gun, limited already in its weight, was seriously handicapped by this need of a minimum muzzle-velocity and was forced to use a light shell quite apart from any question of range.

In 1915 the trench mortar was reintroduced when a portable gun was wanted for the attack of an entrenched enemy and of trenches close to our line. Shortly after came the discovery of the great man-killing effect in the open of the trench mortar bomb with an instantaneous fuze.

This discovery when applied to high explosive shell in general produced a marked change in the position of portable guns. It became possible to obtain considerable man-killing effect independent of remaining velocity.

Portable guns can now use for man-killing a shell of any weight convenient to handle so long as it can be fired far enough. The low muzzle velocity admissible gives them the advantages of a curved trajectory.

These advantages of shell power and curved trajectory are so great as to make probable the disappearance of portable guns with a flat trajectory and using shrapnel.

The flat trajectory has the advantage in sniping that the first shell arrives without warning. But on the other hand in mountain fighting, though a fuze unaffected by barometer may be produced, there will always be difficulty in bursting shrapnel correctly owing to the effect of relatively small errors in measuring the angle of sight.

TYPES.

Many kinds of portable gun were tried but 3 main types emerged from the War, namely, the 6″ Mortar, the 3·7″ Q.F. Mountain Howitzer and the 3″ Stokes' Mortar.

Artillery Training 1920 groups under Pack Artillery the present Mountain guns and the 6″ Trench Mortar which are Portable guns. But to arrive at their proper rôle it is essential to consider all portable

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guns together and so to include the 3″ Stokes' Mortar though it is an Infantry weapon. The table below shows the principal features of these three types.

		6″ Mortar (Pack Type)	3.7″ Q.F. How.	3″ Stokes.
a.	Mules to carry gun.	3.	8.	1.
b.	Wt. of gun complete.	710 lbs.	1800 lbs.	105 lbs.
c.	Wt. of heaviest part.	160 lbs.	240 lbs.	49 lbs.
d.	Time into action.	4 mins.	2 mins.	½ min.
e.	Degree of simplicity.	2nd.	3rd.	1st.
f.	50% zones at mean range (length)	55 yds.	30 yds.	17 yds.
	„ „ „ (breadth)	25 yds.	3 yds.	17 yds.
g.	Degree of steadiness.	2nd.	1st.	3rd.
h.	Extreme Range.	1800 yds.	5800 yds.	750 yds.
i.	Wt. of shell.	48 lbs.	20 lbs.	11 lbs.
j.	Rate of gun fire.	12	12	20
k.	Means of steadying projectile.	Wings.	Rifling.	None.

(a), (b), (c) show comparative portability. The 6″ Mortar (pack) was only used in Italy and did not reach France till after the Armistice. The ordinary 6″ Mortar weighs without sub-bed 600 lbs. but its heaviest part weighs 400 lbs.

(c) must be considered if using indifferent pack animals or when man carriage is needed for any distance.

(e) a general estimate for comparison.

(f) accuracy varies with charges. Mean range taken as half extreme range. No regular 50% zones for 3·7″ Q.F. are yet available.

(g) A bad platform affects each mounting to a different degree and so the accuracy of fire—the 3″ Stokes being very much affected. Comparing with (e) simplicity is seen to be paid for in steadiness.

(i) and (j) combined give the fire power 580 lbs. per min. in the case of the 6″ Mortar which is greater than that of any medium or light gun.

(The 2·75″ B.L., the latest Mountain Gun, travels on 6 mules and fires a 12½ lb. shell to a range of 5,800ˣ. During the War its shell power was generally considered inadequate and, though in detail of design there is much room for improvement, it is doubtful if the difficulty of shell power can be overcome.)

EMPLOYMENT.

It is now proposed to outline what is probably the most suitable employment of these main types, as they exist at present.

Trench Warfare.

Attack.—6″ mortars cut wire and bombard the front line system from attack positions. In this their accuracy at short ranges and

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cheapness of ammunition is utilised. A certain number would move forward in pack or by hand in touch with the Infantry to deal with unexpected strong points.

3·7″ Q.F. are in readiness at zero hour to advance in pack and reinforce the barrage while the field batteries are getting forward through the area of trenches and shell holes. During the War there were many occasions when success could not be exploited owing to the delay whilst tracks for guns were made across the devastated belt. When the field batteries arrive and take over the barrage the 3·7″ would drop out and prepare for the next bound.

3″ Stokes advance by man-carriage with the Infantry for bombing trenches, shell-holes, etc., practically as a long range bomb-thrower.

Ammunition must be limited owing to the labour in carrying it forward and so not many guns can be taken.

Defence.—Fixed positions for 6″ Mortars are sure to be located in the end and will draw fire on themselves and their neighbours. To obviate this frequent change of position is essential and mortars should be concentrated in turn opposite different portions of the front and used offensively. The greater the concentration the more will the attention of the enemy be focussed on the defence of his own line and he will soon realise that there is no use hoping to find the mortars still there when the trouble is over.

6″ Mortars should not be expected to join in the defensive barrage or to fire odd rounds in retaliation. The personnel are better employed in making central bomb stores and dug-outs, and in moving ammunition and guns for the next local offensive than in standing by to answer calls or trying to make shell-proof gun pits.

3·7″ Q.F. would be in reserve coming in to join in local offensives. They would only be used as sniping guns when others are not available.

3″ Stokes are best employed to barrage hidden ground rather as a high angle Lewis gun. If used to harass enemy trenches, they also should be kept constantly moving.

Moving Warfare.

Attack.—6″ Mortars advance in pack or draught in close support to deal with M.Gs., strong points, houses, etc., besides targets in the open. Their high trajectory would prove particularly effective in woods and in street fighting. In 1918 they were used with success for close support but the mortars were not adapted to pack and the difficulty often was to get them up in time.

3.7″ Q.F. advance in pack or draught according to country giving close support. Their shell power would be sufficient on most occasions and they are very quick into action from draught. In their last offensives the Germans used their 75$^{m/m}$ Mortar, adapted to low-angle fire and drawn by horses in this way. Also one British division, finding their 6″ Mortars not sufficiently mobile, replaced them with captured 75$^{m/m}$ mortars in the advance of 1918 and found them of great service.

3″ Stokes would again be employed for bombing houses, etc., but only in small numbers owing to their limited range and accuracy.

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Defence.—6″ Mortar and 3″ Stokes would seldom, if ever, be used. The 3·7″ Q.F. however can readily get off roads and into action in fenced or ditched country and, having a fair amount of range, would be useful in rear guard actions.

Anti-Tank.—The low striking velocity of the Mortars gives them very small chance of disabling a tank but the 3·7″ Q.F. should be able to do so at short range.

Mountain Warfare.

6″ Mortars can clear any crest and search any reverse slope. Their moral and material effect would be very great and they fill as far as possible the place of medium artillery. Their short range will however preclude their employment in the rear guard.

3·7″ Q.F. have sufficient range for all probable situations. Having a wide choice of covered positions, their presence could often be concealed till fire is opened.

3″ Stokes are not likely to be required in addition to the other types.

Forest Warfare.

Often the main line of advance is confined to a few bad roads through forest and marsh, and the only observation obtainable is from the front of the column. The curved trajectory of all these types allows them to be kept close up to the observing officer.

In defence the noise of guns firing makes them an easily found mark for a flank attack through the forest. Flat trajectory guns having to be kept back so as to clear the trees must be provided with separate protection, but guns with curved trajectory being close up are protected by the Infantry line.

The weapon and equipment needed depends so much on the roads, the climate, the state of the ground, etc., that it is impossible to generalise but one or other type will prove suitable.

With the 3·7″ Q.F. a certain amount of shrapnel or case must always be carried for close defence when there is danger of high explosive shell bursting on intervening trees.

Uncivilised warfare in open plains.

The 3·7″ Q.F. often working draught is probably the only portable gun needed.

Transport.

The extent to which portable guns employ draught, pack or man-carriage will vary with the country and the situation. Naturally they will use draught as far as possible and only such echelons as may operate off roads will be in pack. In this way a pack battery may work entirely in draught, in draught each section being convertible into a subsection in pack or with firing battery only in pack.

In deciding the animal and method to be used it is well to study local practice which is generally suited to the climate, needs and natural resources of the country. For instance, there should be very good outside reasons before mules are imported into a country where none are already in use—it probably means they are not suitable.

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Man carriage will only be employed when unavoidable as in African jungle, very broken ground and trenches. The short range of the Stokes type, however, will make it necessary for them to go into action on most occasions by man-carriage.

THE MODERN PORTABLE GUN.

The modern portable gun is limited in many respects. First of all it must be adaptable. There cannot be a type designed specially for each of the various tasks and theatres of war, and there are obvious advantages in having few but adaptable types.

These types are further limited and their design is, in practice, a balance between the claims of the following considerations:—

Portability.
Simplicity.
Range.
Shell Power.
Accuracy.

Portability.—The portable gun, though suited on occasions to carriage by man-power, should be able to travel in pack or in draught.

For marching by man-carriage alone no one-man load should be more than about 60 lbs. 250 lbs. is about the heaviest weight it is ever convenient to move by man-carriage and then only for a short distance. (It was lack of portability in this respect which killed the 9·45″ Trench Mortar).

Suitability to pack puts a limit to the weight, the shape and the position of the centre of gravity of each part. 220 lbs. should be the absolute maximum weight of any part and it is better to keep it down to 200 lbs. to allow for having to use indifferent pack animals. A weight is more easily carried as two side-loads than as a single top-load.

(It is of interest to note that each mountain equipment produced of late years has shown a slight increase in the weight of the heaviest part besides an increase in the number of loads.)

A fairly narrow wheel track has many advantages if used with single or tandem draught, but animals working in pairs abreast take as much room as a vehicle of full width.

Simplicity.—From the nature of the work to be done simplicity is essential: the fewer and stronger the parts and the simpler their assembly the better.

It would appear that the 3·7″ Q.F., requiring 8 mules to carry it, has reached the limit permissible in number of parts and total weight and that future effort in design must be directed towards simplification.

Range, Accuracy and Shell Power.—It is the tendency of all guns to try to extend their range. Portable guns must firmly curb this ambition, as extra range means extra weight or loss of shell power. For the longest range type the limit is in the region of 6,000 yards. Assuming the gun can always be placed within 500 yards of the front line, this will allow fire to a depth of 5,500 yards

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which will be generally beyond what is needed and beyond the range of observation. When fire to a greater depth is needed time will usually be available to bring up other guns, if necessary in parts. (During the War special narrow-track transporters were evolved for moving various guns in parts in mountainous country).

Radical increases in range can be obtained with the mortar types by lightening the bomb or by adding to the charges, but the results are likely to be disappointing. At these new ranges the proper degree of accuracy will only be maintained at the expense of extra weight and complication of the mounting, and might even call for rifling and buffers. The lighter the bomb the more difficult it is to obtain accuracy—the less the radius of action of the shell the smaller is the inaccuracy that can be tolerated in the gun.

It appears, therefore, with the simple portable gun that, where a light shell is essential, a short range must be accepted and that the first increase of range, besides adding to the weight of the gun, must also bring a heavier shell. Eventually when still greater range is required the shell will be lightened but considerable complication of the gun must occur.

In fixing the minimum weight of shell, man-killing effect should be the test. A demoralised enemy may be induced to retire by the noise of small shell but this would not justify the adoption of a shell which is too small to destroy him if he remains.

So long as the shell is not more than a one-man load (i.e. 60 lbs.) its weight does not much affect ammunition supply, as it is only the total weight of ammunition which is limited.

The degree of accuracy required is further modified by the fact that the portable gun acting in the forward area is dependent on a line of supply which is generally difficult and exposed. The ammunition on reaching the gun has an enhanced value and must be economised. The gun therefore should be reasonably accurate.

As it often depends for success on surprise, the portable gun should be capable of developing a high rate of fire for a short time.

It is plain that no single gun can meet all requirements and that there must be more than one type. Whatever may be the selected types, co-ordination of their development is needed so as to avoid useless overlap. The growth of each type should be directed with reference to the growth of the others.

Disadvantages.—The portable gun has comparatively short range and must occupy positions near the enemy. It takes in most cases an appreciable time to get into and out of action. Its rate of advance is sometimes, but by no means always, slower than that of field artillery.

Advantages.—The mortars are economical but the enhanced value of the ammunition already referred to modifies to some extent the economy claimed for them during the War. It is hard to assess exactly the value of lives and labour.

The fundamental advantages of the portable gun are more tactical than economic.

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(i). In movement it can utilise cover to a greater degree than any other gun.

(ii). Owing to its curved fire and portability it can find cover close to the observation post, gaining thereby short communications.

(iii). It can fire over the heads of the Infantry at short ranges and search behind the cover of the enemy.

Principles of Employment.

The portable gun is essentially a weapon of offence and is particularly suited to giving close support to an attack.

If used in defence its short range forces it into positions where it is liable to be overrun and rendered ineffective in the first rush of the attack. This was amply shown during the German attacks of 1918.

Success will be found in offensive action and movement.

These lines are written in the hope that they present some of the problems of this type of gun, even if the solutions are not agreed to.

During the War portable guns, whether mountain guns or trench mortars, enjoyed great unpopularity. The Infantry hated them because they drew fire and most people treated them as a devilish concern to be avoided when possible.

The cause of it all was that they were handled as a rule without definite policy, few experienced officers having had time to study them. It may not be too much to hope that closer acquaintance will lead to a full appreciation and use of the power of these guns.

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INFANTRY GUNS—A REPLY.

By Major A. H. Burne, d.s.o., R.A.

TWO or three articles have recently appeared in the Journal containing criticisms of my article on "Infantry Guns." In particular an article in the November issue accuses me of condemning Mountain Artillery without giving any reasons and without stating what my practical experience with that arm is. Such an accusation seems to call for a reasoned reply.

The fact is, the whole purport of my article has been missed and I expect it will astonish anyone who has read the critique, but not the article criticised, to learn that so far from condemning this equipment it is admitted on p. 2 of the article that the mountain gun "is the nearest approach at present existing to the type of gun required."

How then has this misunderstanding arisen? Probably the explanation is as follows: A few lines previous in the article I had specified some of the special requirements as regards mobility for the type of gun I had in mind; now the points in which I was "positive" (if you like) that *pack* artillery did not come up to the standard I was envisaging were rapidity in coming into action and limbering up, and speed in movement of the gun and its detachment.

Surely it is self-evident, and even a layman could allow himself to be positive, that a gun which has to be put together and put upon wheels and taken off them before coming into and going out of action will take longer to do so than a similar one which is permanently on wheels?

Surely it is equally self-evident that pack artillery cannot move so fast, with their detachments, as guns on wheels with limbers for the detachment to ride on? Was it necessary to give reasons for these two assertions?

As regards the necessity for moving fast we have the opinion of a Mountain Gunner, in the April issue, that the guns in a rearguard action should be able to move three times as fast as the Infantry. Can pack artillery do this? My criticisms were directed to pack artillery *qua* pack: they had no reference to guns on wheels as the passage quoted above clearly shows. Also the article has no reference to mountain warfare. It is obviously concerned with normal warfare in a civilised cultivated country. But owing to the omission (an evident clerical error) of the word "all" in the passage objected to, my words might have been taken to mean that *in no respects* is Pack Artillery Mobile, which, as Euclid says, "is absurd."

The fact is, the article was written to discuss the ideal properties of an "infantry gun" and to show that the 18-pounder did not possess them.

But if I may be allowed the privilege, I would like to suggest a few points in which the existing mountain equipments, though better than the 18-pdr., appear to fall short of the ideal weapon for advanced

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or rearguard work with infantry in civilised cultivated country where roads, trees, hedges, walls, and buildings, may in varying degree be encountered—in other words, in the sort of warfare in which our home troops may expect to be engaged, which for want of a better word we will call "European" warfare.

For convenience we will use the words "Ideal" Gun to denote the weapon described in the original article.

A.—PACK.

I.—*Speed in coming into and going out of action.*

If a 18-pdr. can come into action front, lay, and fire a round, in 12 seconds, a gun 3 times as light ought to be able to do the same thing in at least as short a time. Sometimes it all depends on who gets in the first round. At Ypres in 1914, Lieut. Blewitt in his historic duel with a German $77^{m/m}$ managed to get in the first round, and thereby won the contest. If you are spotted by the enemy's machine guns whilst in the act of coming into action you will have very few seconds in which to complete the job. Every second will make a difference.

Then as regards getting out of action again, a gun in close contact with hostile infantry is always in a ticklish position owing to the difficulty of covering its own flanks, and the noise with which it advertises its position. If in a rearguard action the gun is to hold on till the last possible moment (which it nearly always should do) the knowledge that it can limber up and trot or gallop away in a few seconds is of moral support to the detachment and enables and encourages them to take bigger risks and remain longer in action than a pack gun which is going to take almost 4 minutes to limber up and after that can only move slowly.

II. *Vulnerability.* "The strength of a chain is its weakest link." And pack artillery has many weak links in the form of the 6 or 8 mules required to transport the gun, quite apart from the mules which carry the ammunition. If a single one of these gun mules has an accident, becomes a casualty, or bolts, the whole gun is *ipso facto* placed out of action until that mule has been replaced. Capt. Pemberton appears to make use of the rather dangerous argument that if two mules in different detachments simultaneously become casualties the two guns can amalgamate into one. Put in other words—the loss of two mules may reduce your gun power by 50%. If the two mules happen to be carrying the same portion of their respective guns the section goes out of action altogether and if the two guns are acting singly (which my article advocates as the normal way) the loss of two mules will incapacitate the two guns temporarily whether corresponding mules are the casualties or not. Now turn to a wheeled gun. Horses in draught are less likely to become casualties than mules owing to the lessened chance of their stampeding. But even if two horses of different guns become casualties the gun can still go on, if drawn by a team of three by cutting out the leader, if by a pair by putting the No. 1's horse in draught.

The ammunition mules and the numerous drivers are all additional links in the chain, and the loss of a single man in the pack

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detachment hinders and modifies the drill for getting out of action, whereas with the "ideal gun" two gunners could limber up as quickly as twenty. In short the latter has very much more *material cohesion* than the former.

III. *Size of target.* Assuming that the "ideal" gun has a team of one pair, with one driver, or 3 horses in single file and 3 drivers, with a detachment consisting of No. 1 mounted, Nos. 2 and 3 riding on the gun limber, as suggested in my article, we can compare the total target presented in the normal case where only a few rounds are to be fired, say 16.

"Ideal" Gun.

Detachment	3 men
Drivers	1 (or 3)
Horses	3 (or 4)
Total ... 4 (or 6) men	3 (or 4) horses.

3·7 inch.

Detachment	9 men	
Gun Mules	8	
Ammn. Mules	2	
Drivers	10	
Total 19 men	10 mules	per gun.
38 men	20 mules	per section.

The latter is about 4 times as big a target as the former. A body of about 40 men with very little protection within a few hundred yards of machine guns, even if out of sight, are fortunate if they escape any casualties. Here you have no less than fifty-eight living units, the incapacitation or removal of any one of which is going to adversely affect your arrangements for getting the guns away. Whereas with draught you have more material cohesion between the different units which are necessary to plant the shell on the right spot at the right time.

It may be objected that a detachment of three is too small, even for a light gun of this nature. Of course the ground and the season are important factors, but as an example of what can be done, the 50th Brigade, R.F.A., used their guns in such a manner time and again in October and November 1918, with detachments of three in order to offer smaller targets to the enemy's machine guns, and used them with striking success. If an 18-pounder can be brought into and taken out of action by three men, a gun one-third its weight can too.

As a matter of fact it is only for small tasks at short range that the detachment would be limited to three. For a bigger task requiring a bigger expenditure of ammunition Nos. 4 and 5 would come up with the wagon.

It has been argued in favour of pack artillery that the pack method of transport was found very useful in the late war. Everyone knows that pack transport was largely resorted to in the crater area

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on the Somme and in 3rd Ypres. But a crater area is a product of *time*, and time allows of the necessary evolution of pack transport. Also a crater area belongs to trench warfare, the relatively unimportant and stagnant period of a war. The important and mobile periods (when time does not allow of the evolution of anything new) are the beginning and end periods. In the late war it was "touch and go" with us in the first period, and only the high standard of training in open warfare of our army pulled us through.

Again towards the final and decisive stage of a war the victor at any rate has the power of movement. Crater areas are not formed in wars of movement. Hence any argument based on crater area warfare should not be allowed to weigh if it runs counter to our training or equipment for open warfare. Such would be a lamentable and reactionary policy. Let us concentrate our every effort on forging a weapon fitted for that which alone gives decisive victory—namely a war of movement.

Is it essential for a weapon such as the 3·7 inch which can shoot up to 5,900ˣ to be able to accompany the infantry "wherever they go"? Surely the important point is that the *shell*, not the tube from which the shell is projected, shall accompany—or rather "pre-vent" the infantry "in all their doings". For "European" war as defined above, roads are not likely to be denied to the guns, and so the necessity for, or advantage of, pack artillery is reduced.

B.—DRAUGHT.

(1). *The absence of a limber.*

A limber has the following advantages:—

(a). The detachment can ride with the gun.

(b). The carriage can move at a rapid pace.

(c). The ammunition accompanies the gun instead of having to bring up pack mules, each with a driver for the purpose.

(d). A brake can be applied when travelling.

(e). The limber, or wagon, can be left in action as protection for the detachment if desired.

(f). Complicated drill on coming into and going out of action is avoided.

As regards (*b*), according to Major Bell's article Nos. 2 and 3 have at present to walk alongside the gun with drag-ropes to "help the mules at starting and stopping, and up and down sudden short slopes." This is not surprising if 2 mules are set to haul a howitzer weighing 1,800 lbs.

The reason why a 13 or 18-pdr. can get over a surprisingly big bank or ditch at a trot or gallop, whereas the 2-wheeled mess cart and water cart come to grief when they attempt to follow is because the former is a 4-wheeled vehicle where the mass of weight does not suddenly fall on the pole, and the wheelers can pull with little interference from the rapidly changing balance of the vehicle behind them.

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As regards (*c*), if the gun can get to the required spot we know that the detachment and ammunition will *ipso facto* be there too as the same motive power conveys both: whereas without a limber either the detachment or ammunition or both might get separated from the gun. Also the ammunition mules and their drivers offer more material for "cannon fodder."

As regards (*d*), it is obvious that if you apply the brake to a two-wheeled vehicle, the weight is immediately transferred to the horse's back.

As regards (*f*), one has only to compare the elaborate detail described in Major Bell's Article with the beautiful simplicity of an 18-pdr. to realise the advantage of the limbered type in this respect. In fact it is the acme of simplicity. An eye has to be lifted off a hook, the hook moves away, and the force of gravity is allowed to exert itself upon the eye, *et voilà tout*—the gun is in action and can be pointed in any direction at the will of the detachment. If it is a case of "action rear" ten seconds or less should complete the operation!

(2.) A rate of fire of five rounds per minute is too slow for effective work by single guns.

(3). The 3·7 inch has an unnecessarily heavy shell and long range for the purpose of the "ideal gun" whose aim is to supplement the 18-pdr., not to replace it.

(4). The 2·75 inch has no traversing gear for use against tanks.

(5). The danger (easily conceivable when guns are in pack) of the shafts getting lost, damaged, or stampeded with.

(6). *Organisation*. The organisation of a mountain battery is on a two-gun section basis. For the reasons given in my article (which, though I did not state it, were based on experience of this form of fighting at the end of the war) a one-gun section seems preferable. For the reason given in (2) above this does not appear suitable for the 2·75 inch. In any case an increased number of officers and signallers would be necessary.

(7). *Bigger target* (in the case of the 3·7 inch) i.e. at least 7 men and 4 mules, as against 4 men and 3 horses.

Conclusion.

If a pack gun which is convertible to draught can be evolved which overcomes the above seven shortcomings, then so much the better: we shall then have attained the advantages of both schools. All I contend is that every condition necessary for the wheeled "infantry gun" for use in "European" warfare should be satisfied before pack considerations are allowed to weigh. If in order to make it possible to carry this gun in pack it is found that some of the conditions essential to a wheeled gun must be sacrificed, then I say the pack idea for the gun in question should be given up.

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GALLIPOLI STRATEGY.

By Lieut.-Col. C. Holmes-Wilson, (late) R.F.A.

THERE is an old axiom that action and reaction are equal. Following this it seems safe to assume that after the strenuous efforts of the War a period of lethargy must occur before the chief events are considered with interest. The public as a whole appears to be tired of War stories and the small tales told only interest those who took part in the events described. In matters of strategy it may, however, be possible to open up a wider field for discussion.

The strategical events that led up to the final defeat of the enemy on the Western front are still too involved to admit of investigation. In the Mediterranean area however, matters can now be appreciated from an independent standpoint. The chief actors have laid their cards on the table and the thread of the story can be picked up from the disclosures that have already been made.

The controversy between the Navy and the Army is sufficiently well defined to admit of criticism. What, however, is generally forgotten is that history has repeated itself. During the Napoleonic Wars Constantinople was attacked by a British Fleet. The Armament, consisting of eight ships of the line, two frigates and a few smaller vessels, entered the Straits on 19th February, 1807. The passage was effected with small loss and the fleet anchored off Constantinople on 21st February. The consternation there was great, as an immediate bombardment was feared. Prevarication had however, always been a prominent feature in the diplomatic armoury of the Porte, with the result that acting under the advice of Sebastiani, Napoleon's agent, negotiations were opened and time was gained in which to strengthen the defences of the Dardanelles. When the fleet had eventually to retire it ran the gauntlet of the forts and lost over three hundred men. This example had however, apparently made little impression on the strategists of 1915, who hoped to accomplish under modern conditions what history had already proved to be impossible. The campaign in the Peninsula begins and ends with this miscalculation. It is to a great extent an epitome of the event. Too much reliance had been placed on modern developments and in assessing the increase of power involved the degree of proportion had been lost. When credit was given to gun power on ships, the mine fields and land defences were ignored. Hence the failure that ensued. The Fleet having failed the Army was pushed into the forefront, though it had originally been detailed to play an auxiliary part. When this change of plan was decided on, it was evident that a climax had been reached.

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The general attitude adopted up to date in considering these questions has been, to take the events as they occurred and then abuse those on the spot for not having forced the passage in the face of tremendous odds. This piecemeal criticism serves no useful purpose, as a consideration of the chief events of the campaign proves that the failure was strategical not tactical. Recent literature tends to confirm this view and shows that the strategic conditions involved had not been fully appreciated when the expedition was launched. The original scheme was based on the assumption that the Fleet could force the passage of the Dardanelles.[1] This had apparently been prepared in London. In its conception the plan was simple, provided the information received and the deductions drawn were correct. When, however, the preliminary premises broke down the strategic principles involved collapsed like a house of cards. Then the great error occurred, instead of building on a sounder basis, the original scheme was pursued to the bitter end and the expedition gathered weight like a snowball till it eventually—in a haphazard way—assumed the proportions of an enterprise of the first magnitude.

It will consequently be observed that the success of the expedition was jeopardised from the outset. The instructions given to the Commander-in-Chief were abstruse and amounted in effect to a statement that "if possible a landing was to be avoided, none was to be "attempted till the fleet had made every effort to penetrate the Straits "and had failed, if a landing became unavoidable none should be "made until the full force available had assembled and no adventurous "operations were to be undertaken on the Asiatic side."[2] The strategic situation was consequently reduced to one in which the Commander-in-Chief was tied to the toe of the Peninsula. His army was an auxiliary to the Fleet. The Fleet had, however, hoisted the red flag for action—like the Roman Consul Varro at Cannæ—before it was in a position to act. Having bombarded the outlying forts in the Straits on 3rd November, 1914, as an experiment, the Navy allowed the matter to drop.[3] The plan of campaign had, however, then been given away and it was too late to make amends; under these conditions, when giving every credit to the Navy, it seems obvious that a strategic mistake had been made.[4]

Having cleared the ground to this extent it may be asked why a free hand was not given to both arms at the commencement of the campaign. Sir Ian Hamilton arrived at Mudros to find the situation cut and dried as Sir Redvers Buller had found it when he landed at Cape Town fifteen years before. The general conditions were undoubtedly different but the main facts were analogous. In each case the C.-in-C. was committed to a policy formulated for him at home,

[1] "The sailors are sure they can force the Dardanelles on their own and the whole enterprise has been framed on that basis, we are to lie low and to bear in mind the Cabinet does not want to hear anything of the Army till it sails through the Straits."—Sir Ian Hamilton, Gallipoli Diary.

[2] Dardanelles Commission.

[3] The order to bombard was given by the Admiralty, the Naval Commander in Chief in the Mediterranean described the bombardment as a mistake.—"Dardanelles Commission."

[4] Lord Fisher in referring to the Dardanelles expedition stated: "I must reiterate that as a purely naval operation I think it was doomed to failure." Dardanelles Commission Majority Report.

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and on arrival in the theatre of operations when he represented his forces as being inadequate, his representations were ignored.

Had these disturbing elements been eliminated the campaign might have had a different end. Early in September, 1914, the General Staff drew up a plan for an attack on Gallipoli by a Greek Army of 150,000 men.[1]

Sir Ian Hamilton, however, only had a total of seventy thousand, and of these not more than sixty thousand were effectives. In spite of this, the expedition might have succeeded if a rapid blow had been struck without any preliminary fuss. There would then have been four strategic alternatives from which to choose, namely, a landing on the Asiatic Coast, the occupation of the foot of the Peninsula, an assault on the Bulair Lines, or a descent on Enos.

Of these alternatives, the most remarkable is the proposed attack on the neck of the Peninsula. Here the Bulair Lines blocked the way to the south. Constructed first during the Crimean War these lines have historical associations connected with the British Army, during a period in which Turks fought side by side with Britons in the defence of the Dardanelles. Later they figured again in history, when they were reinforced to resist the aggression of Russia and Bulgaria. There was consequently nothing new in the suggestion that, though the tables were turned and Britain was now the assailant, Bulair might not again become a point of strategical importance. It is not necessary to refer to German ingenuity to provide an excuse for this very apparent plan. The secret of Bulair was held by history, though the key had yet to be found, as the lines had never been attacked. Sir Ian Hamilton in his diary admits that he had an open mind in regard to the matter at the commencement of the campaign, but later his views appear to have hardened. He brings forward objections and drawbacks and then finally condemns the scheme; but it must be borne in mind that this was at a stage in which the enemy had had time in which to prepare. The difficulties were then intense, and the man on the spot cannot be blamed. Had Sir Ian seen Bulair previous to the bombardment of 3rd November, he would probably have formed a different opinion. It is easy to be wise after the event, but if it had been possible to recast the campaign and land the troops on virgin soil unsullied by any preliminary bombardments, it seems likely that the fleet might have been guaranteed a secure passage. Even at the eleventh hour some of the leading generals wished to turn away from the forbidding heights that dominated the approaches to the toe and foot of the Peninsula. For instance, the Anzac Staff appears to have been in favour of a landing between the Bay of Xeros and Enos. Sir Ian, harrassed by various schemes and plans, remarks:—"For this I have no use as though I think we should "doubtless be able to effect a landing there pretty easily, yet I do "not see that we should be any "forrarder" by doing so, we might "put ourselves in front of the Bulair Lines, but there would be far "less object in attacking them and working south-west, with the "Navy only partially able to help us, than by working up from the "other end with the Navy on either flank."

[1] Gallipoli Diary.—Sir Ian Hamilton.

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The obvious criticism on this—if criticism is permissible—is that the Navy could not work up from the other end and that owing to this it was essential that some other point of attack should be selected. Another drawback put forward has been, that the Turkish lines of communication did not run through Bulair, but down the Asiatic coast and then across the Straights.[1] This statement has still to be proved, but for the moment its accuracy seems immaterial, as had the Bulair Lines been seized, the Straits and Asiatic coast would have been within Artillery range so that the other line of communication, if it existed, would have fallen too.[2] In addition, the lines would have afforded a defensive position against a possible counter-attack from the north. The problem as considered is not put forward as a criticism of those in authority on the spot, but merely as a suggestion as to what might have happened had a decisive blow been struck at the commencement of the campaign, when the enemy was unprepared at Bulair.

Following the same line of argument a reference may be made to the possibility of an Asiatic landing. Several prominent officers appear to have favoured this—General D'Amade and General Birdwood amongst others. The former wished to land at Adramyti, the latter somewhere south of Tenedos. The distances separating their objectives did not vary by more than thirty or forty miles. Under such conditions it might be supposed that some mutual understanding existed, was it not for the fact that neither appear to have met before the fatal decision to attack the Southern end of the Peninsula was reached at the conference held on the "Queen Elizabeth" at Lemnos on 10th April.[3]. General D'Amade and General Birdwood had thus apparently approached the matter from an independent standpoint, and arrived at the same conclusion. This in itself is a matter of importance, as it is evident that our Allies and the Colonials did not see eye to eye with the policy laid down by the Home Government. Sir Ian Hamilton had been forbidden by the War Office to land in Asia, and consequently dismisses the matter with the brief remark that he "had been given no roving commission to conquer Asia".[4] Later, however, when he had been promised a reinforcement of three regular divisions and the infantry of two Territorial divisions he sums up his alternative plans, for what was destined to prove his final effort, in a clear and masterly manner. Having referred to the landing of further troops in the southern sector of the Peninsula, he proceeds to consider the possibility of an attack on the Asiatic side of the Straits, followed by a march on Chanak. He points out that the Turkish forces on the Peninsula would be weakened by such a landing and that the beaches about Cape Helles would be freed from artillery fire from the Asiatic coast. In considering the matter further he states that he found unless he had sufficient men to make a whole-hearted attack on the enemy in the Peninsula, he would reap no advantage in that theatre from the transference of the Turkish

[1] A much longer route, unless the supplies were carried by sea.
[2] The distance across the Straits is about 5 miles.
[3] Gallipoli Diary.
[4] Gallipoli Diary.

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peninsular troops to reinforce Asia, whereas the British forces landed in Asia would not be strong enough in themselves to seriously threaten Chanak, with the result that the Turks would not relax their hold on the Peninsula.[1] This opinion appears decided and disposes of the possibility of recasting the scheme before the first shot was fired, so far as the Asiatic Coast is concerned. To cross the Straits meant dividing the forces available for use, and this in itself would have been a source of weakness as long as the fleet could not effect a passage. In addition the area involved was considerable and the troops operating against Chanak would have been exposed to the risk of an attack in rear. Under these conditions, Lord Kitchener seems to have been fully justified in putting a ban on operations on the Asiatic side.

The two main alternatives embodied in the proposal, to land an army before the Navy had opened fire have now been discussed. The third remains, the possibility of landing at Enos and working round towards Bulair. This involved a flank march in the face of possible potential forces based on Rodosto. These, though they might not have proved a serious menace to the first advance, would probably have threatened the line of communication as the operations developed. Sir Ian Hamilton, in referring to the matter at a later date, when the intentions of the enemy were known, says "A landing between Saros Bay and Enos would leave us no forrarder. There we should be attacked in front from Rodosto, in flank from Adrianople, in rear from Bulair, whilst as we advanced we would lose touch with the fleet."[2] It must, however, be borne in mind that this appreciation was made at a time when the Russians had met with reverses in Asia Minor and were asking for help in the form of a military demonstration on the European side of the Straits. An Army landed at Enos at the end of 1914 might have proved of material assistance to the forces of the Czar operating in the Black Sea area. At the eleventh hour, however, when many Turkish divisions had been set free, an expedition in this quarter could not have been carried out without employing a large number of men. As a result it was not considered. The fourth Alternative, the landing in the toe of the Peninsula, needs no comment, the details are already known and every honour must be given to those who fought and fell in what eventually proved to be a desperate enterprise. They made the supreme sacrifice and their memory must remain with us, in spite of any strategic mistakes that may have been made.

The crux of the problem, however, still remains. The question as to whether the Fleet could effect a passage without the assistance of an army, and whether under the circumstances it would not have been preferable for the Fleet to have held its hand till the army was ready. Delay could have done no harm, provided the Home authorities were working in unison and certain of their ground. On the other hand, it must be admitted that the intermittent attempts made gave grounds for some hope of success. The bombardment of 3rd November seems to have been unnecessary. It was, however, followed by other sporadic efforts till eventually a final attempt was

[1] Sir Ian Hamilton's Third Despatch.
[2] Gallipoli Diary.

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made on 18th March, in which several capital ships were lost. In referring to these attacks, Enver Pasha is reported to have said:

"If the English had only had the courage to rush more ships "through the Dardanelles they could have got to Constantinople, "but their delay enabled us to thoroughly fortify the Peninsula, "and in six months time we had taken down there over 200 "Austrian Skoda guns."[1]

If this statement is to be taken seriously it is obvious that it must have been the bombardment of 3rd November that led to the first alarm.[2] This receives further support in an enemy publication published by Dr. Stuermer. Speaking of the naval bombardments, he says:—

"To their great astonishment the gallant defenders of the coast "forts found that the attacks had suddenly ceased. Dozens of "the German naval gunners, who were manning the batteries "of Chanak on that memorable day, told me later that they had "quite made up their minds the fleet would ultimately win and "that they themselves could not have held out much longer."[3]

This report refers to the bombardment of 18th March, and in view of the fact that the Straits were mined its accuracy may be doubted.

In the earlier stages it is possible that had a determined effort been made the scheme might have succeeded, though there is no certainty as to whether when the Fleet had reached Constantinople it would have been able to maintain its communications. As long as the land communications of the enemy remained open, it would have been possible for him to lay mines and bring up Skoda guns. Under these conditions had the enemy shown a bold front when Constantinople was threatened, Admiral Carden might have shared the fate of Admiral Duckworth, who had difficulty in extricating his flotilla in 1807, when he had no army to assist him. The natural conclusion to be drawn from these events as a whole, consequently, appears to be that had the Navy waited for the Army—limited as its numbers were—the element of surprise might have been brought into play and great results achieved. The difficulties experienced in supplying troops, however, provides an excuse for the course followed, though it must be admitted that the precipitate policy pursued at the commencement of the campaign did not tend to lead either towards unity of thought or concerted action.

The Army in Gallipoli had no opportunity for strategic manœuvre till it was reinforced by the IXth Corps at the end of July. It had been tied to trench warfare. Attack had followed attack, over what were already beaten tracks, and in spite of the gallantry of the troops no headway could be made. With the advent of reinforcements a new prospect was, however, opened and fresh possibilities brought forward. The command of the sea made a landing possible at any point, the question remained as to how far the command of sea, taken in conjunction with existing conditions, made decisive

[1] Dardanelles Commission First Report.
[2] Van der Goltz is said to have reconnoitred the Dardanelles in February.
[3] Two War Years in Constantinople.

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action possible. As has already been pointed out Sir Ian Hamilton had banned an attack on Bulair[1] and was prohibited by his instructions from attempting any adventures on the Asiatic coast. Under these circumstances the only strategic alternative left was a landing at Suvla. Hard and fast lines tied him down to certain localities. It is immaterial that the Peninsula at Suvla happened to be wider than in other places. It was the only landing place left from which he could carry out an attack on his objective—the Narrows. Historians may possibly view the matter from a different standpoint, and regard the Narrows as a magnet towards which all forces were impelled, when greater results might have been achieved by attacking a point of less obvious importance. Napoleon at Jena masked his intentions by making a frontal attack on the Prussians, while Davout cut off their retreat at Auerstadt. Sir John Moore in the Peninsula Campaign changed his base by the aid of sea power, when he was faced by overwhelming odds. In Gallipoli, however, both the Fleet and the Army based their hopes on one elusive objective. When it became apparent that this could not be achieved a change of plan was impossible. Given a free hand at the outset of the campaign Sir Ian Hamilton would have been in a position to form his own plans. When, however, he was asked to re-adjust his dispositions, his field of action was cramped. The army had already tramped the ground allotted to it till every hole and corner of tactical importance had been fully explored. To resume the tramp in the same direction would have been suicide. To extend it involved adopting one or other of the courses that had already been condemned. Under these conditions an intermediate line had to be adopted, and this could only be found by probing the alley that lead from Suvla to the flank of the position already held. As a result the New Army was committed to a new landing that eventually proved an overgrown offshoot of the venture that had already failed. In conception it gave great promise—in execution it strongly resembled the efforts made to relieve Ladysmith. Forbidding heights barred the view and these appear to have frightened those in responsibility with the result that no determined attack was made. As in South Africa the limit of vision seems to have contracted the limit of thought, with the result that the "terrain" apart from any movements made by the enemy proved an obstacle to freedom of movement. The constant fear as to what might happen, instead of what would happen if a determined attitude was adopted, seems to have become the dominating feature of the effort. This in itself meant failure. The Army Command was hardly pressed. The enemy was in a position to strike. If he struck in the south it was clear that the small footing gained on the Peninsula could not be held.

Under these conditions the arrival of reinforcements was most opportune. As the tenth legion loved Cæsar and he loved it, so did the Commander-in-Chief fix his affections on the IXth Corps in the hope that it might save him from defeat. The story of the IXth Corps is, however, both romantic and tragic. It was brought into being at a period when the Empire was hardly pressed and arrived

[1] General Liman von Sanders expected the landing to be attempted near Bulair—on the flat isthmus that joins the Peninsula to the mainland.

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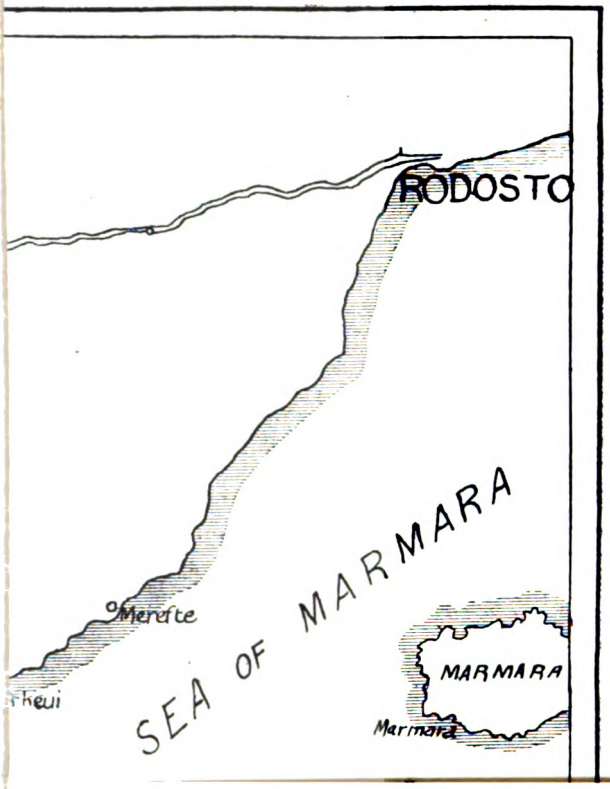

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engaged in serious fighting with the object of [illegible]
ing at Suvla—the 11th Division was embarking at Imbros

[1] Gallipoli Diary.
[2] A landing of Levantine troops was attempted there.

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in the Peninsula when matters had reached a crisis. On it depended the success or failure of the Eastern enterprise, that had already caused so much heartburning on the Western Front. It was the first of the New Armies used in the East, and as such it was an object of interest in the military world, and more liable to either censure or praise according to its actions. History has proved that the New Armies did wonders later, the IXth Corps, their forebear may consequently be regarded as unfortunate. It nominally consisted of the 10th, 11th and 13th Divisions, but when the landing at Suvla took place the 13th Division and the 29th Brigade of the 10th Division had been detached for service with the Anzac Corps. As a result General Stopford had only the 11th Division and two brigades of the 10th Division available for use. In addition, he was short of guns and at the time of the landing his artillery had been reduced to one 18-pounder battery and two mountain batteries. The Corps was, however, landed on an open beach where no opposition was expected and under the circumstances should have been able to advance before the Turks brought up reinforcements. The reports of aerial reconnaissances sent to the Army Command showed "not more than 100 to 150 yards of trenches, in all half a dozen gun emplacements and no Turks anywhere on the move".[1]

The plan of operations, though comparatively simple, necessitated a close co-operation between the different forces involved. The main effort was the landing at Suvla, combined with an attack on Koja Chemen (Hill 971). In addition three subsidiary movements had been arranged embodying the occupation of Lone Pine Plateau, an advance against Achi Baba and a demonstration at Bulair.[2] This enterprise—which was the largest that had been attempted—began with the assault of Lone Pine and Achi Baba on 6th August. The attack on the latter was continued till the 8th, when it was broken off, having served its purpose by tying down Turkish reinforcements to the toe of the Peninsula that might otherwise have been used at Suvla. The fighting in which the Anzac Corps was engaged was, however, of a more desperate nature; the main operation was directed against Koja Chemen, with a view to co-operating with the IXth Corps advancing from Suvla. The covering movement on Lone Pine was carried out in support of this general attack. The main attack under General Godley was divided into right and left covering columns and right and left assaulting columns. Starting during the night of the 6th, the New Zealanders carried the summit of Chunuk Bair on the morning of the 8th and obtained a momentary glimpse of the Dardanelles, the Land of Promise, for which the Expeditionary Force had been fighting since the early spring. On the 9th, portion of the Indian Brigade occupied Hill "Q" and had another view of the Straits. Then the tide turned, and these gallant troops were driven back without meeting the IXth Corps that they had been sent to help.

In the meantime, the IXth Corps had been pursuing its leisurely way. On the 6th, when the Anzacs and the troops at Helles were engaged in serious fighting—with the object of facilitating the landing at Suvla—the 11th Division was embarking at Imbros. During

[1] Gallipoli Diary.
[2] A landing of Levantine troops was attempted there.

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the night, before 10 p.m., the first ships appeared off Suvla Bay, and the landing was commenced. By dawn the division was ashore, and shortly after daybreak it was reinforced by six battalions of the 10th Division. The moment for action had then come, but the Divisional Generals appear to have been informed that they were not to attack without artillery support and that trenches met with were to be turned.[1] The anomaly of the situation is, of course, apparent, the artillery could not land until the infantry had made its landing possible. If, however, the infantry could not advance without the artillery, it would have been better if both had remained afloat. The different arms have certain functions to perform and it was not the duty of the artillery to make the first move. The Turks at the moment were numerically inferior and had few guns at their disposal. A determined attack on the part of the infantry might consequently have cleared the way for a decisive advance. Nothing, however, was done on 7th. Then on 8th Sir Ian went to Suvla and on landing met Colonel Aspinall, who informed him that "our chances were being thrown away with both hands and that he had already cabled me to that effect." The Commander-in-Chief, with the consent of the Corps Commander, then interviewed the Divisional Generals, and finally ordered the 32nd Brigade to advance. But at this crisis of the action, when nearly forty-eight hours had already been wasted, the staff of the division failed to find the battalions forming the Brigade.[2] Sir Ian has been criticised for interfering, but, realising that the golden moments were slipping away and having been informed by aerial reconnaissances that the enemy was hurrying up reinforcements by both sea and land, he seems to have been justified in making a bid for the high ground at any cost. That his judgment was correct may be proved by the fact that the advance of the 32nd Brigade, which did not commence till 4 a.m. on 9th August reached in his own words "the high water level of the advance made at dawn by the rest of the division".[3] This, however, also appears to have been the limit of the forward movement of the Corps, to whose destinies the campaign in the Near East had been intrusted. The operations of the 8th, having failed the 9th, saw Turkish reinforcements debouching on what was to prove the decisive field so far as Gallipoli was concerned. The Anzacs were falling back and the sacrifices made at Lone Pine and Koja Chemen had been made in vain. In the opinion of the Commander-in-Chief the Suvla enterprise failed "as driving power was required and even a certain ruthlessness to brush aside pleas for a respite for tired troops. The one fatal error was inertia and inertia prevailed.[4] Criticism is possibly undesirable, but it may be pointed out that on 8th August we still had a numerical superiority and as the landing at Suvla had been effected on 6th, there should have been time in which to put matters right before the 9th, when the enemy brought up his reinforcements. Three days had elapsed, and in three days much might have been done to rectify any initial mistakes that had been made. Even on

[1] Sir Ian Hamilton's Third Despatch.
[2] Ibid.
[3] Ibid.
[4] Ibid.

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8th August the enemy was only credited with having 4,000 men on the Anafarta Heights, and as late as the 15th his forces were estimated at 20,000, when he had had the opportunity of deploying his reserves. Under these conditions the failure of the venture reaches proportions beyond those generally assumed. The water supply was a phase of the first landing. This, however, appears to have provided a cue for the events that followed, with the result that delay followed delay.

From the strategical point of view it will consequently be seen that the supreme effort was a catalogue of catastrophes. Rapidity of action was the main factor required, if any definite decision was to be reached. Such a decision was, however, rendered impossible when the main effort failed, with the result that the opportunity was lost of bringing the War to an end by subduing the Near East. As a consequence the final decision was passed back to the main theatre, in spite of the efforts made to divert the crisis by carrying on a separate campaign in the East.

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NOTES ON FOREIGN JOURNALS.

America.

National Service—Jan. 1921.

Contains an interesting Editorial on "World Politics and the Expectation of Peace," and Reviews at some length Gen. Gascouin's "Evolution of Artillery during the war."

Journal of the United States Artillery—Dec. 1920.

Joint Army and Navy Action in Coast Defence. Railway Artillery (from Army Ordnance. Nov.—Dec. 1920.)

Belgium.

Bulletin Belge des Sciences Militaires—January 1921.

I. The operations of the Belgian Army 1914-1918 (Series).

II. The Strategic importance of Dutch Limburg and the defence of the Meuse. (Continued.) Lt.-Col. d'E. M. Nuyten.

III. The officer's rôle in war. (Continued.) Capt. Menzel.

V. Notes on Foreign Armies.

Switzerland.

Revue Militaire Suisse.

Contains an article by Col. Feyler called "Strategie des petits paquets". Gen. Sarrail had under him in Macedonia, English, French, Russian, Italian, Serbian, and Greek Contingents. He had to fit in the orders he got from G.H.Q. Western Front with the political aspirations of the various governments. He is reported on one occasion to have burst out "Now that I have first hand knowledge of what a war of coalition is, I think considerably less of Napoleon". Col. Feyler says that this saying leads to an interesting comparison. He takes Napoleon's campaign of Austerlitz, Jena, and Friedland, as an example of how much easier the Strategy of Concentration is than that of "small parcels."

Although the English, Austrian, Prussian and Russian coalition were stronger than the French, each battle with the exception of Eylau found them outnumbered and beaten.

The Austrians at Ulm, Russians at Austerlitz, Prussians at Jena, and Russians again at Friedland.

Result. Napoleon who was originally weaker had enough troops to impose his will on the exhausted coalition. Col. Feyler then turns to the Macedonian Campaign 1915-1918 and shows how the Central Powers with concentrated strategy, for years scored off the strategy of "small parcels."

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"DUNCAN" GOLD MEDAL COMPETITION, SUBJECT FOR 1920-21.

The Subject approved for the "Duncan" Gold Medal Prize Essay 1920-21, is as follows:—

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for horse draught, both on the road and across country."

The Rules for the Essays now read:—

The Annual Gold Medal, when awarded, to be accompanied by an *honorarium* of £20; the Silver Medal by an *honorarium* of £10.

The subject will be a Field (including Horse) Artillery subject one year and a Garrison (including Mountain) Artillery one the next year.

The candidates must be Officers of the Regiment who are members of the R.A. Institution.

Officers of the R.H.A. and R.F.A. will be allowed to compete for the Garrison Artillery subject, and Officers of the R.G.A. for the Field Artillery subject.

Officers are requested to confine their Essays to about 16 printed pages of "The Journal of the Royal Artillery." other things being equal, brevity will count towards success.

The Essays must be forwarded to the Secretary so as to reach him on or before the 1st of April, 1921, they should be marked "Duncan Essay" on the outside of the cover which should be sealed.

Each Essay must be type-written in triplicate. The Essays must be strictly anonymous, but each to have a motto, and be accompanied by a sealed envelope with the motto written outside and the name of the writer inside. Only one of these sealed envelopes is required for each set of Essays not three.

Further, if the writer wishes to recover from the Committee part of the cost of typewriting his Essay he should state this fact in the same sealed envelope, and write outside it, above the motto, "To be opened." All the envelopes thus marked will be opened by the Secretary after the result of the competition has been announced, and he will send the writers the money for their type-writing expenses. The Committee will allow a sum of £1 for type-writing each Essay.

The prize Essays and those commended become absolutely the property of the R.A.I. and cannot be published by the author without the sanction of the Committee. The remaining Essays, if applied for, will be returned, and can be used by their authors.

The Essays will be submitted for decision to three Judges chosen by the Committee.

The Judges are empowered to recommend:—

1.—That two Medals, one Gold and one Silver, be awarded, or

2.—That only one Medal, Gold or Silver, according to the merit of the Essay, be awarded, or,

3.—That no Medal be awarded.

The names of the successful candidates will be announced at the Annual Meeting, and Medalists will be distinguished as such in all Lists, &c., issued from the Institution, and in the event of a University man gaining a Medal, a report of his success will be made to the University of which he may be a member.

The Gold and Silver Medal Essays will be printed and circulated to members by the Institution.

If there are any Essays which do not gain a Medal but are commended by the Judges, it will be at the discretion of the Committee to publish them or not as they think fit.

N.B.—The Committee draw particular attention to the paragraph in the Rules above on the subject of length of Essays; a page of the "Journal" is roughly 550 words.

SUBJECT FOR 1921-22.

Officers who have any suggestion as to a suitable subject for the "Duncan" Medal Essay competition for 1921-22, should send the same to the Secretary, R.A. Institution, before the 1st April, 1921.

The subject for the year in question should refer to Garrison Artillery.

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Staff College, Camberley.—List of Graduates.

Extract from Army Order 6 of 1921.

A list, arranged in regimental order, of officers who have recently graduated at the Staff College, is given below:—

Bt. Col. Finlayson, R. G., C.M.G., D.S.O., R.F.A.
Bt. Lt.-Col. Lewin, E. O., C.B., C.M.G., D.S.O., R.F.A.
Bt. Lt.-Col. Haining, R. H., D.S.O., R.F.A.
Bt. Lt.-Col. Carrington, R. H., D.S.O., R.F.A.
Bt. Lt.-Col. Longmore, C. M., D.S.O., R.F.A.
Major Archdale, A. S., D.S.O., R.F.A.
Bt. Lt.-Col. Hutchison, H. O., D.S.O., M.C., R.F.A.
Major Imbert-Terry, H. B., D.S.O., M.C., R.F.A.
Major Dendy, M. H., D.S.O., M.C., R.F.A.
Major Allen, R. H., M.C., R.F.A.
Major Lambert, A. F., M.C., R.F.A.
Bt. Lt.-Col. Nugent, W. V., C.B.E., D.S.O., R.G.A.
Major Hickes, L. D., O.B.E., M.C., R.G.A.
Bt. Major Douglas-Jones, S. D., D.S.O., M.C., R.G.A.

Staff College, Quetta.—List of Graduates.

Extract from Army Order 546 of 1920.

A list, arranged in regimental order, of officers who have recently graduated at the Staff College, Quetta, is given below:—

Major F. E. Spencer, D.S.O., M.C., Royal Artillery.
Major W. H. B. Atkinson, Royal Artillery.
Captain F. N. Mason-Macfarlane, M.C., Royal Artillery.

REGIMENTAL LIST. The following Postings have taken place from 16th December, 1920, to 15th January, 1921.

R.H. and R.F.A.

RANK & NAME.	FROM.	TO
	15/12/20.	
Lieut. Barlow, A. E.	D.G.R.E. Southn. Comd.	D.G.R.E. Eastern Comd.
,, Bareham, V. A.	D.G.R.E. London Dist.	do.
,, Clarke, A. V.	D.G.R.E. Southn. Comd.	do.
,, Douglas, E. H. E.	D.G.R.E. Northn. Comd.	do.
,, Spendlove, W. H.	D.G.R.E. Southn. Comd.	do.
,, Terry, H. J.	D.G.R.E. Northn. Comd.	do.
,, Bettridge, R. F.	D.G.R.E. Irish Comd.	D.G.R.E. Scottish Comd.
,, Carson, T.	do.	do.
,, Cox, F. G. L.	do.	do.
,, Merton, H. H.	A.D.C. to G.O.C. Black Sea.	81/5th Bde., R.F.A.
	16/12/20.	
Major Fraser, A. H.	Attd. Ordnce. College.	R.F.A., India.
	18/12/20.	
Major Lloyd, O. S.	III Res. Bde., R.F.A.	2 D.A.C. on promotion to Lt.-Col.

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Postings R.H. &. R.F.A.—*Continued.*

RANK & NAME.	FROM.	TO
	21/12/20.	
Major Ballard, J. A., D.S.O.	18/3 Bde., R.F.A.	19th Bde., R.F.A.
Lieut. Bell, J. G.	V Res. Bde., R.F.A.	Unposted (Ordce Course).
Major Harris, O. M., D.S.O. Bt.LC	Comdg. 2nd Wessex Bde. R.F.A., T.F.	1st Bde., R.H.A., pending promotion.
Major Hornsby, F. H.	Attd. 1st E. Anglian Bde., R.F.A., T.F.	146/1st Bde., R.F.A.
Major Laurie, K. C. Bt.LC	4/4th Bde., R.F.A.	17th Bde., R.F.A., pending promotion.
Lieut. Lumsden, E.	Attd. Tank Corps.	G.H.Q., Ireland.
LtCol. Parsons, W. F., C.M.G. D.S.O.	2nd Bde., R.F.A.	8th Bde., R.F.A.
Major Queripel, L. H., C.M.G., Bt.LC D,S,O,	65/28th Bde., R.F.A.	28th Bde., R.F.A., pending promotion.
Major Stewart, D.	22/34th Bde., R.F.A.	10th Bde., R.F.A.
Major Taylor, G. J. S.	49/12th Bde., R.F.A.	2nd Bde., R.F.A., pending promotion.
Major Webber, H.A.W., C.B.E.	56/34th Bde., R.F.A.	22/34th Bde., R.F.A.
LtCol. Wickham, T. E. P., D.S.O.	23rd Bde., R.F.A.	2nd Bde., R.H.A., on appmt. to R.H.A.
2/Lt. Wilson, W. R.	50/34th Bde., R.F.A.	56/34th Bde., R.F.A.
	22/12/20.	
Lieut. Atkins, W. F.	11th Bde., R.F.A.	21st Bde., R.F.A.
,, Clements, H. T. W.	do.	20th Bde., R.F.A.
,, Harriss, F. A.	D.G.R.E., France.	I Res. Bde., R.F.A.
,, McCombie, H. H.	D.G.R.E. Irish Comd.	D.G.R.E. Scottish Comd.
,, McBarnet, A. A. E.	11th Bde., R.F.A.	32nd Bde., R.F.A.
,, Mitton, W. A.	do.	do.
,, Paton-Walsh, E. J.	do.	20th Bde., R.F.A.
,, Wright, W. B.	do.	21st Bde., R.F.A.
,, Savile, W. A. B.	D.G.R.E. Irish Comd.	D.G.R.E. Scottish Comd.
	24/12/20.	
Lieut. Kennerson, A.	40/25th Bde., R.F.A.	I Res. Bde., R.F.A.
	29/12/20.	
LtCol. Cuninghame, E. W. M. D.S.O.	13th Bde., R.F.A.	Comdg. 11th Bde., R.F.A.
	31/12/20.	
Lieut. Baldwin, C. L.	12th Bde., R.F.A.	V Res. Bde., R.F.A.
2/Lt. Drew, C. H.	25/35th Bde., R.F.A.	12/35th Bde., R.F.A.
Lieut. Elliott, A. A. H.	II Res. Bde., R.F.A.	School of Artillery.
,, Garland, J. B.	12th Bde., R.F.A.	V Res. Bde., R.F.A.
Capt. Rainy, A. R. Bt.-Maj.	143/15th Bde., R.F.A.	"G" Bty., R.H.A., on appmt. to R.H.A.
Major Shilstone, W. R., M.B.E.	Attd. Ordnce. College.	121/27th Bde., R.F.A.
LtCol. Twidale, W. C. E., C.M.G., D.S.O.	Attd. R.A.O.C.	Comd. 30th Bde., R.F.A.
Lieut. Vaisey, J. T. de H.	12/35th Bde., R.F.A.	G.H.Q., Ireland.
,, Voysey, J. E.	61/14th Bde., R.F.A.	Attd. G.H.Q., Ireland.
	1/1/21.	
Capt. Power, K. W.	B.M.M., Vladivostock.	Unposted List.
	5/1/21.	
Capt. Cockaday, W. G. C., (D.O.), M.C.	India.	No. 2 Depot, R.F.A.
	6/1/21.	
2/Lt. Carr Harris, L.	R.M.C., Kingston, on appointment.	32/33rd Bde., R.F.A.

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Postings R.H. &. R.F.A.—*Continued.*

RANK & NAME.		FROM.	TO
		7/1/21.	
Lieut.	Ashe, V. C.	D.G.R.E., France.	R.F.A., India.
2/Lt.	Aldridge, R. B.	R.M.A., on appmt.	45/31st Bde., R.F.A.
,,	Austin, C. G.	do.	49/12th Bde., R.F.A.
,,	Battine, O. L. St. C.	do.	50/34th Bde., R.F.A.
,,	Bernard, B. F.	do.	98/1st Bde., R.F.A.
,,	Bloxam, G. C.	do.	7/4th Bde., R.F.A.
,,	Drake-Brockman, R. F. H.	do.	19/9th Bde., R.F.A.
,,	Leggatt, W. M.	do.	1/37th Bde., R.F.A.
,,	Longfield, R. C.	do.	6/12th Bde., R.F.A.
,,	MacGregor, I. O'B.	do.	29/31st Bde., R.F.A.
,,	Palmer, J. W.	do.	137/8th Bde., R.F.A.
,,	Roberts, L. W.	do.	18/3rd Bde., R.F.A.
,,	Robertson, F. E.	do.	28/9th Bde., R.F.A.
,,	Stephen, M.	do.	38/14th Bde., R.F.A.
		8/1/21.	
Capt.	Evelegh, E. D., M.C.	University Course.	12th Bde., R.F.A.
Major Bt.LC	Longmore, C. M., D.S.O.	Staff College Course.	Adjt., 35th Bde., R.F.A.
Capt.	Mackie, W. B., M.C.	12th Bde., R.F.A.	3rd Bde., R.F.A.
		10/1/21.	
L-Col.	Asser, V., C.M.G., D.S.O.	Attd. 3rd Bde., R.F.A.	Comd. 31st Bde., R.F.A.
,,	Bourchier, R. W. H. D.S.O.	Attd. 37th Bde., R.F.A.	Comd. 37th Bde., R.F.A.
,,	Balston, G. R.	25/35th Bde., R.F.A.	Comd. 7th Bde., R.F.A.
Major	Butchart, J. A.	Attd. 35th Bde., R.F.A.	31/35th Bde., R.F.A.
L-Col.	Cameron, O. S., D.S.O.	54th Wessex Bde., T.F.	III Res. Bde., R.F.A.
Lieut.	Kite, A. F., M.C.	H.Q. 28th Div. Arty.	28th B.A.C., R.F.A.
Major Bt.LC	Meade, G. W., D.S.O., M.C.	Attd. 6th Bde., R.F.A.	77/6th Bde., R.F.A.
L-Col.	Naper, L. A. D., D.S.O.	Attd. 1st Bde., R.F.A.	Comd. 1st Bde., R.F.A.
,,	Riddell, J. B., D.S.O.	80/15th Bde., R.F.A.	Comd. 35th Bde., R.F.A.
,,	West, F. G., D.S.O.	31/35th Bde., R.F.A.	Comd. 12th Bde., R.F.A.
,,	Warren, L. E., D.S.O.	20/9th Bde., R.F.A.	Comd. 36th Bde., R.F.A.
,,	Williams, R. C., C.M.G. D.S.O.	77/6th Bde., R.F.A.	Comd. 6th Bde., R.F.A.
		11/1/21.	
Lieut.	Anderson, W.	28th Bde., R.F.A.	10th Bde., R.F.A.
,,	Birch, A. H., M.C.	do.	do.
Major	Crewsdon, W. T. O.	do.	do.
Lieut.	Fischer, T. F.	do.	do.
,,	Jennings, M. B.	do.	do.
,,	Kite, A. F., M.C.	do.	do.
2/Lt.	Murray, D. M. J.	do.	do.
Lieut.	Saunderson, H. V.	do.	do.
Major	White, J. L. C., M.C.	H.Q., Ireland.	15/36th Bde., R.F.A.
Capt.	Barkworth, H. E.	II Res. Bde., R.G.A.	R.F.A., India.
		12/1/21.	
Major	Archdale, A. S.	Staff College.	49/12th Bde., R.F.A.
Capt.	Deacon, H. W., D.F.C.	Attd. 31st Bde., R.F.A.	29/31st Bde., R.F.A.
,,	English, M. W.	35th Bde., R.F.A.	R.F.A., India.
,,	Jackson, C. R., M.C.	Attd. H.Q., Ireland.	129/31st Bde., R.F.A.
		14/1/21.	
Lieut.	Larder, D. A.	Attd. D.G.R.E., France.	R.F.A., India.

Cancellation of Postings.

Major Leech, C. J. F. Posting to I Res. Bde. from IV Res. Bde., dated 15/11/20 is cancelled.
Posting of Major A. H. Fraser to R.F.A., India, dated 16/12/20 is cancelled.
Posting of Lieut. J. Neale, M.C., to 24th Bde., India, dated 6/11/20 is cancelled.
Posting of Lieut. D. W. R. Sawer to 32nd Bde., India, dated 5/11/20 is cancelled.

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Postings R.H. &. R.F.A.—*Continued.*

The units of the undermentioned Officers are as now stated:—

Capt.	Morgan, W. D., D.S.O., M.C.	—	29th Bde., R.F.A.
,,	Hodges, A. P., M.C.	—	3 D.A.C., India.
Lieut.	Greest, P. W.	—	25th Bde., R.F.A.
Major	Marriner, B. L.	—	do.
Lieut.	Price, C. F. J.	—	22nd Bde., R.F.A.

Staff Appointments.

RANK & NAME.	FROM.	TO
	1/10/20.	
Lieut. Bateman, J. S., M.M.	Offg. G.S.O. G.H.Q., Mespot.	G.S.O. 3, "O" G.H.Q., Mesopotamia.
	16/11/1920.	
Major Smithson, H.	—	Garrison Adjt., Bulford.
	18/11/20.	
Major Nicholls, W. A., D.S.O.	Bde. Major, India.	D.A.A. & Q.M.G., 18th Indian Divn.
	1/12/20.	
Capt. MacIlwaine, A. H., D.S.O., M.C.	138/8th Bde., R.F.A.	Bde. Maj. R.A., 2nd Div.
	14/12/20.	
Lieut. Holland, V. C.	IV Res. Bde., R.F.A.	A.D.C. to Genl. Franks. Turkish Sub-Commn.
	23/12/20.	
Major Imbert-Terry, H. B. D.S.O., M.C.	Staff College Course.	G.S.O. 3, M.I. 2 War Office.
Lieut. Richardson, S.	R.A.S.C. Records.	Graded Class "H.H." whilst at R.A.S.C. Recds.
	1/1/21.	
Major Allen, R. H., M.C.	Staff College Course.	G.S.O. 2, A H.Q., India.
Col. Harding-Newman, E.	Half-pay.	C.R.A., 18th Ind. Divn. Temp. Col. Comdt. whilst so employed.
	3/1/21.	
Major Carrington, R.H., D.S.O. B.L.C.	Staff College Course.	G.S.O. 2, S.D. 2, War Office.
	7/1/21.	
Major Lambert, A. F., M.C.	Staff College Course.	G.S.O. 3, S.D.3 A., W.O.
Lieut. Barton, H. E.	16th Bde.	S. Capt. G.H.Q., Egypt.
	11/1/21.	
Capt. Barkham, E. G.	4 Depot, R.F.A.	Adjt. (on prob.). Chemical Warfare Exptl. Station.
	16/1/21.	
Major Dendy, M. H., D.S.O., M.C.	Staff College Course.	B.M., R.A., 2nd Divn.

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Royal Garrison Artillery.—Postings.

RANK & NAME.	FROM.	TO
	15/12/20.	
Major de Cetto, V. B. A.	D.G.R.E. Northn. Comd.	D.G.R.E. Western Comd.
Lieut. Maconochie, H. A.	D.G.R.E. Irish Comd.	D.G.R.E. Scottish Comd.
Major Tresidder, G. W.	D.G.R.E. Aldershot.	D.G.R.E. Southern Comd.
	16/12/20.	
L-Col. Rowan-Robinson, H., C.M.G., D.S.O.	H.Q. & D.E. Mainland, Portsmouth.	Attd. H.Q. & D.E. Tees & Tyne. To comd. on 1/1/21.
	17/12/20.	
Lieut. Hall, E. G. F.	R.G.A., Malta.	5/2nd Brit. Pack Bde.
	23/12/20.	
Capt. Barry, R. J.	H.Q. & D.E. Portsmouth & Portland.	H.Q., Irish Comd.
Major Crozier, C. D. B.L.C.	Attd. 10th Bde., R.G.A.	do.
Major Carey, J. L. R., D.S.O.	36 Fire Comd.	do.
Major Cruikshank, P. H.	Attd. Coast Art. School.	do.
Capt. Curtis, A. D.	H.Q. & D.E., I of W.	do.
,, Chapman, A. C.	11 Fire Comd.	do.
Major Hibbert, S. E.	Attd. I Res. Bde., R.G.A.	do.
,, Kirkpatrick, C. D., M.C.	Attd. 8th Bde., R.G.A.	do.
,, Lane, H. E.	do.	do.
,, Mitchell, P. R., D.S.O.	11 Fire Comd.	do.
Capt. O'Leary, B. J.	Sudan Detachment.	do.
Major Pratt, E. R., M.C. B.L.C.	Attd. Min. of Munitions.	do.
Major Rothwell, R. S., D.S.O.	2 Brit. Pack Bde.	do.
Capt. Roberts, H. W., O.B.E.	Portsmouth Defences.	do.
Lieut. Hutchison, E. A. O.	Staff Capt., France.	"B" Coast Battery.
	24/12/20.	
Lieut. Somerville, R. A. E.	D.G.R.E., France.	Thames & Medway Defs.
	30/12/20.	
Major Kemble, H. M.	11 Fire Command.	H.Q. Irish Comd.
,, Pepper, J. W.	13 ,,	do.
	31/12/20.	
Lieut. Dobson, N. H.	I Res. Bde., R.G.A.	31 Fire Command.
Capt. Gurney, L.	29th Battery, R.G.A.	Attd. 1st Pack Bde.
	8/1/21.	
L-Col. Rumbold, W. E., C.M.G.	Attd. H.Q. and D.E., Forth.	H.Q. & D.E., Clyde & N. Scottish.
2/Lt. Aylmer, C.	R.M.A., on appmt.	13/4th Bde., R.G.A.
,, Bellamy, A. T. N.	do.	20/5th Bde., R.G.A.
,, Caple, H. F. D.	do.	18/5th Bde., R.G.A.
,, Collin, J. T. D.	do.	19/5th Bde., R.G.A.
,, Cobbold, R. C.	do.	40/10th Bde., R.G.A.
,, Dickinson, A. B. de C.	do.	38/10th Bde., R.G.A.
,, Fendall, W. P.	do.	36/9th Bde., R.G.A.
,, Gyde, W. J.	do.	39/10th Bde., R.G.A.
,, Gould, H. C.	do.	27/7th Bde., R.G.A.
,, Hemming, W. W.	do.	14/4th Bde., R.G.A.
,, Meats, G. W.	do.	15/4th Bde., R.G.A.
,, Mercer, L. W.	do.	30/8th Bde., R.G.A.
,, Maddox, R. H.	do.	31/8th Bde., R.G.A.
,, MacNeece, J. F. D.	do.	32/8th Bde., R.G.A.
,, Nicholson, M. J. J. S.	do.	28/7th Bde., R.G.A.
,, Oldfield, E. A. L.	do.	33/9th Bde., R.G.A.
,, Ross, H. A.	do.	26/7th Bde., R.G.A.
,, Spedding, J. E.	do.	35/9th Bde., R.G.A.
,, Way, E. R. H.	do.	16/4th Bde., R.G.A.
Capt. Merrett, A. B.	India.	D.G.R.E., Western Comd.
	10/1/21.	
L-Col. Moore, W. H.	Sen. Officers Course.	Comd. Thames & Medway Defences.

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RANK & NAME.	FROM	TO
	12/1/21.	
Major Cream, P. T. C., M.C.	D.G.R.E. Eastern Comd.	G.H.Q., Ireland.
Capt. Fasken, D. E.	S. Capt. T. & M. Area.	do.
	13/1/21.	
Capt. Floyd, B. E.	C.M. Duty, Ireland.	R.A. Survey Company.
Lieut. Hirst, H. W. (D.O.).	On Appmt. to D.O.	Attd. R.G.A., Gibraltar.
Major Martin, W. M. J., D.S.O.	Adjt. 3rd Northumb'n. Bde., R.G.A., T.F.	32/8th Bde., R.G.A.
,, Waring, J., D.S.O. B.L.C.	32/8th Bde., R.G.A.	Adjt., 3rd Northumbrian Bde., R.G.A., T.F.
Capt. Shewell, H. C.	Attd. R.A.O.C., Portsmouth.	C.M. Duty, G.H.Q., Irel'd.

Cancellation of Postings.

Lieut. Dowling, J., posting to India, dated 5/10/20.
Lt.-Col. Rumbold, W. E., C.M.G., posting to H.Q. & D.E., Forth, dated 13/12/20.

Staff Appointments.

	16/10/20.	
Capt. Clarke, R. G.	G.H.Q., Ireland.	Attd. Officer, Queenstown, No. 1 Area, Ireland.
	18/12/20.	
Lieut. Craney, C. R.	Sierra Leone.	Employed with W.A.F.F.
	21/12/20.	
Bt.-Maj. Douglas-Jones, S. D.	Staff College Course.	G.S.O. 3, S.D. 1, W.O.
	22/12/20.	
Major Hickes, L. D., O.B.E., M.C.	Staff College Course.	G.S.O. 2, Nigeria Regt., W.A.F.F.
	1/1/21.	
Bt. Lt.-Col. Lewis, H.A., C.B.E.	Supt. of Expts.	Sec., Ordce., Committee.
Major Clapham, D., D.S.O., O.B.E.	Exptl. Establishment.	Supt. of Expts., Exptl. Establishment.
Bt.-Maj. Gay, C. H., D.S.O.	A.A. & Q.M.G., France.	Dep. Asst. Cont. of Surp. Stores & Salvage, W.O.
	7/1/21.	
Bt. Lt.-Col. Nugent, W. V., C.B.E., D.S.O.	Staff College Course.	G.S.O. 2, Intell., G.H.Q., Egypt.

REGIMENTAL LIST. The following Casualties have occurred during the period 16th December, 1920 to 15th January, 1921.

First Appointments.

The undermentioned Gentlemen Cadets from the R.M. Academy to be 2nd Lieuts. with effect from the 23rd December, 1920.

Aldridge, R. B.
Austin, C. G.
Aylmer, C.
Battine, O. L. St. C.
Bellamy, A. T. N.
Bernard, B. F.
Bloxam, G. C.
Caple, H. F. D.
Cobbold, R. C.
Collin, J. T. P.
Dickinson, A. B. de C.
Drake-Brockman, R. F. H.
Fendall, W. P.
Gould, H. C.
Gyde, W. J.
Hemming, W. W.
Leggatt, W. M.
Longfield, R. C.
MacGeorge, I. O'B.
MacNeece, J. F. D.
Maddox, R. H.
Meats, G. W.
Mercer, L. W.
Nicolson, M. J. J. S.
Oldfield, E. A. L.
Palmer, J. W.
Roberts, L. W.
Robertson, F. E.
Ross, H. A.
Spedding, J. E.
Stephen, M.
Way, E. R. H.

Carr-Harris, L. H., 2nd Lieut., 5th June, 1919, from R.M. College, Kingston.

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Promotions.

Arbuthnot, Lt.-Col. A. G., C.M.G., D.S.O., to be Colonel, 13th March, 1920.
Asser, Major & Bt. Lt.-Col. V., C.M.G., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Ballard, Major J. A., D.S.O., to be Lt.-Col., 3rd Jan., 1921.
Ballingall, Major H. M., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Balston, Major G. R., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Bethell, Lt.-Col. A. B., C.M.G., D.S.O., to be Colonel, 16th June, 1920.
Bourchier, Major & Bt. Lt.-Col., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Burn, 2nd Lieut. I. M. P., to be Lieut., 10th Dec., 1920.
Buzzard, Lt.-Col. F. A., D.S.O., to be Colonel, 9th Aug., 1920.
Cameron, Major & Bt. Lt.-Col. O. S., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Clark, Major & Bt. Lt.-Col. C. H., D.S.O., to be Lt.-Col., 3rd Jan., 1921.
Clayton, Capt. & Bt. Lt.-Col. (R.O.) Sir G. F., K.B.E., C.B., C.M.G. (retd.), to be Hon. Brig.-Genl., 8th Dec., 1919.
Cornes, Major H., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Cossart, Major & Bt. Lt.-Col. A. R. B., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Cotton, Lt.-Col. & Bt.-Col. A. S., C.B., C.M.G., D.S.O., A.M., to be Colonel, 3rd June, 1919.
Craig, Lt.-Col. R. A., C.M.G., C.B.E., to be Colonel, 29th Nov., 1919.
Crofton, Major & Bt. Lt.-Col. M., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Crozier, Major & Bt. Lt.-Col. B. B., C.M.G., D.S.O., to be Lieut.-Colonel, 1st Jan., 1921.
De Sausmarez, Lt.-Col. & Bt.-Col. C., C.M.G., D.S.O., to be Colonel, 1st Jan., 1919.
Edwards, Lt.-Col. W. E., C.M.G., to be Colonel, 13th April, 1920.
Ellershaw, Lt.-Col. A., C.B., C.M.G., D.S.O., to be Colonel, 9th April, 1920.
Forman, Lt.-Col. A. B., C.M.G., D.S.O., to be Colonel, 14th March, 1920.
Galloway, Lt.-Col. F. L., C.M.G., to be Colonel, 29th Nov., 1919.
Gordon, Lt.-Col. G. H., C.M.G., D.S.O., to be Colonel, 22nd Aug., 1920.
Goschen, Major & Bt. Lt.-Col. A. A., D.S.O., to be Lt.-Col. 1st Jan., 1921.
Gosset, Lt.-Col. & Bt.-Col. F. W., C.M.G., D.S.O., to be Colonel 1st Jan., 1919.
Harris, Major & Bt. Lt.-Col. O. M., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Henvey, Lt.-Col. R., C.M.G., D.S.O., to be Colonel, 1st Jan., 1920.
Hepper, Lt.-Col. L. L., D.S.O., to be Colonel, 30th July, 1920.
Hezlet, Major & Bt. Lt.-Col. R. K., C.B.E., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Hinde, Lt.-Col. & Bt.-Col. A., C.M.G., to be Colonel, 1st Jan., 1917.
Home, Lt.-Col. & Bt.-Col. R. E., C.B.E., D.S.O., to be Colonel, 1st Jan., 1917.
Howorth, Lt.-Col. H. G., C.M.G., to be Colonel, 29th Nov., 1919.
Ingham, Lt.-Col. C. St. M., C.M.G., D.S.O., to be Colonel, 13th April, 1920.
Johnston, Capt. M. A. B., M.C., to be Bt. Major, 31st Oct., 1920.
Lewin, Lt.-Col. & Bt.-Col. H. F. E., C.M.G., to be Colonel, 1st Jan., 1919.
Mackey, Lt.-Col. H. J. A., C.M.G., D.S.O., M.V.O., to be Colonel, 3rd Jan., 1921.
Mackintosh, Lt.-Col. W. J., D.S.O., to be Colonel, 26th Feb., 1920.
Maturin, Major & Bt. Lt.-Col. R. G., D.S.O., to be Lt.-Col. 1st Jan., 1921.
Moultrie, Lt.-Col. H. C., D.S.O., to be Colonel, 5th Jan., 1920.
Naper, Major L. A. D., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Newcome, Lt.-Col. & Bt.-Col. H. W., C.M.G., D.S.O., to be Col., 1st Jan., 1918.
Nootl, Lt.-Col. C. C., C.M.G., D.S.O., to be Colonel, 20th April, 1920.
Owen, Lt.-Col. C. R. B., C.M.G, to be Colonel, 29th Sept., 1920.
Pringle, Lt.-Col. H. G., D.S.O., to be Colonel, 18th Feb., 1919.
Riddell, Major R. B., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Scott, Lt.-Col. & Bt.-Col. C. W., C.M.G., D.S.O., to be Colonel, 1st Jan., 1918.
Sherbrooke, Major & Bt. Lt.-Col. N. H. C., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Sherer, Lt.-Col. J. D., C.M.G., D.S.O., to be Colonel, 9th May, 1920.
Simpson, Major & Bt. Lt.-Col. H. C., C.M.G., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Smith, Lt.-Col. H. R. W. M., D.S.O., to be Colonel, 21st Aug., 1920.
Stallard, Lt.-Col. S. F., C.M.G., D.S.O., to be Colonel, 6th Feb., 1920.
Stewart, Major D., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Stirling, Lt.-Col. W., C.M.G., D.S.O., to be Colonel, 30th Dec., 1920.
Taylor, Major G. J. S., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Thomson, Major & Bt. Lt.-Col. A. F., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Wainewright, Lt.-Col. A. R., C.M.G., D.S.O., to be Colonel, 18th April, 1920.
Walthall, Lt.-Col. & Bt.-Col. E. C. W. D., C.M.G., D.S.O., to be Colonel, 3rd June, 1919.
Ward, Lt.-Col. H., C.M.G., D.S.O., to be Colonel, 11th Sept., 1920.
Warren, Major L. E., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Weber, Lt.-Col. W. H. F., C.M.G., D.S.O., to be Colonel, 24th April, 1920.
West, Major F. G., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Williams, Major R. C., C.M.G., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Wilson, Lt.-Col. & Bt.-Col. F. A., C.M.G., D.S.O., to be Colonel, 1st Jan., 1920.
Winter, Lt.-Col. O. de l'E., C.B., C.M.G., D.S.O., to be Colonel, 28th April, 1920.

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To Half Pay.

Arbuthnot, Lt.-Col. A. G., C.M.G., D.S.O., 1st Jan., 1921.
Barton, Lt.-Col. P., D.S.O., 1st Jan., 1921.
Bethell, Lt.-Col. A. B., C.M.G., D.S.O., 1st Jan., 1921.
Bishop, Lt.-Col. C. F., 1st Jan., 1921.
Blanford, Lt.-Col. W. G., 1st Jan., 1921.
Butcher, Lt.-Col. F. S., 1st Jan., 1921.
Buzzard, Lt.-Col. F. A., D.S.O., 1st Jan., 1921.
Chevallier, Lt.-Col. F. E. de C., 6th Jan., 1921.
Cotton, Lt.-Col. & Bt.-Col. A. S., C.B., C.M.G., D.S.O., A.M., 1st Jan., 1921.
De Sausmarez, Lt.-Col. & Bt.-Col. C., C.M.G., D.S.O., 1st Jan., 1921.
Ellershaw, Lt.-Col. A., C.B., C.M.G., D.S.O., 1st Jan., 1921.
Farmar, Lt.-Col. W. C. R., 1st Jan., 1921.
Fife, Lt.-Col. R. B., D.S.O., 1st Jan., 1921.
Forman, Lt.-Col. A. B., C.M.G., D.S.O., 1st Jan., 1921.
Furnivall, Lt.-Col. W., D.S.O., 1st Jan., 1921.
Gordon, Lt.-Col. G. H., C.M.G., D.S.O., 1st Jan., 1921.
Gray, Lt.-Col. C. L. R., D.S.O., 1st Jan., 1921.
Hawkes, Lt.-Col. C. St. L. G., C.M.G., D.S.O., 1st Jan., 1921.
Henvey, Lt.-Col. R., C.M.G., D.S.O., 3rd Jan., 1921.
Hepper, Lt.-Col. L. L., D.S.O., 1st Jan., 1921.
Hinde, Lt.-Col. & Bt.-Col. A., C.M.G., 1st Jan., 1921.
Holdsworth-Hunt, Lt.-Col. W. H., D.S.O., 1st Jan., 1921.
Home, Lt.-Col. & Bt.-Col. R. E., C.B.E., D.S.O., 1st Jan., 1921.
Jacob, Lt.-Col. W. H. B., D.S.O., 1st Jan., 1921.
Jones, Lt.-Col. E. H., D.S.O., 1st Jan., 1921.
Kane, Lt.-Col. A. H., D.S.O., 1st Jan., 1921.
Lewin, Lt.-Col. & Bt.-Col. H. F. E., C.M.G., 1st Jan., 1921.
Longton, Lieut. F. P., M.C., 6th Jan., 1921.
McCulloch, Lt.-Col. R. H. F., C.M.G., D.S.O., 1st Jan., 1921.
Mackey, Lt.-Col. H. J. A., C.M.G., D.S.O., M.V.O., 3rd Jan., 1921.
Moultrie, Lt.-Col. H. C., D.S.O., 1st Jan., 1921.
Musgrave, Lt.-Col. & Bt.-Col. A. D., D.S.O., 1st Jan., 1921.
Pringle, Lt.-Col. H. G., D.S.O., 3rd Jan., 1921.
Sherer, Lt.-Col. J. D., C.M.G., D.S.O., 1st Jan., 1921.
Smith, Lt.-Col. A. G., 1st Jan., 1921.
Smith, Lt.-Col. H. B., D.S.O., 1st Jan., 1921.
Smith, Lt.-Col. H. R. W. M., D.S.O., 1st Jan., 1921.
Stallard, Lt.-Col. S. F., C.M.G., D.S.O., 1st Jan., 1921.
Stirling, Lt.-Col. W., C.M.G., D.S.O., 1st Jan., 1921.
Thackeray, Lt.-Col. C. B., D.S.O., 1st Jan., 1921.
Wainewright, Lt.-Col. A. R., C.M.G., D.S.O., 1st Jan., 1921.
Ward, Lt.-Col. H., C.M.G., D.S.O., 1st Jan., 1921.
Williams, Lt.-Col. A. C., C.B.E., 1st Jan., 1921.
Wilson, Lt.-Col. & Bt.-Col. F. A., C.M.G., D.S.O., 1st Jan., 1921.

Retirements on Retired Pay.

Beckett, Lieut. E. H., 18th Jan., 1921, with rank of Capt.
Bryson, Lieut. T. W., 13th Jan., 1921.
Burke, Lieut. F., M.C., 17th Oct., 1920, with rank of Capt.
Burton, Lt.-Col. H. C. H., 1st Jan., 1921.
Charles, Major E. E., D.S.O., 13th Jan., 1921.
Childs, Lieut. E., M.B.E., 18th Dec., 1920.
Cooper, Lieut. F. S., M.C., 15th Dec., 1920, with rank of Capt.
Craig, Lieut. P. M., 13th Jan., 1921.
Davson, Lt.-Col. H. M., C.M.G., D.S.O., 8th Jan., 1921.
Foley, Lieut. S., 17th Oct., 1920, with rank of Capt.
Gibbons, Lieut. J. A., 17th Oct., 1920, with rank of Capt.
Green, Lieut. W. H., M.C., 10th Jan., 1921, with rank of Major.
Hall, Lieut. I., 13th Jan., 1921.
Head, Lt.-Col. A. E. M., D.S.O., 11th Nov., 1920.
Liveing, Lt.-Col. C. H., C.M.G., D.S.O., 8th Jan., 1921.
McCorkingdale, Lieut. D., 15th Jan., 1921.
Matheson, Lieut. A. McK., 20th Dec., 1920.
Meathrel, Lieut. H., M.C., D.C.M., 9th Jan., 1921.
Mills, Lieut. J. E., M.M., 5th Jan., 1921.
Moran, Lieut. J., 24th Oct., 1920.
O'Callaghan, Lieut. J. H., 8th Jan., 1921, with rank of Capt.
O'Kelly, Lieut. J. H. W. M., 4th Jan., 1921.
Peters, Lieut. F., 12th Jan., 1921.
Piper, Lieut. C. E., 5th Dec., 1920.
Simmonds, Lieut. W. G., 13th Jan., 1921.
Snook, Lieut. W. H., 6th Jan., 1921.
Stacey, Lieut. A., 12th Jan., 1921.
Vernon, Major L. D., D.S.O., 12th Jan., 1921.
Wilson, Col. L. M., C.M.G., D.S.O., 18th Dec., 1920.

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Retirements with a Gratuity.

Conlon, Lieut. H., 1st Jan., 1921, with rank of Capt.
Crookshank, Capt. A. C., 14th Jan., 1921.
Dowling, Lieut. J., M.M., 8th Jan., 1921.
Henry, Lieut. A. P. J., 12th Jan., 1921.
McMullan, Lieut. H., 13th Jan., 1921.
Mason, Lieut. S., 12th Jan., 1921.
Neaves, Lieut. J. S., 14th Jan., 1921.
Pressland, Lieut. L. C., M.C., 13th Jan., 1921.
Skinner, Lieut. A., 15th Jan., 1921.
Spurling, Lieut. C. G., M.B.E., 1st Jan., 1921, with rank of Capt.

Resignations.

Capland, Lieut. E. F., 12th Jan., 1921.
Davies, Lieut. O. G., M.C., 6th Jan., 1921.
Frend, Lieut. W. G., M.C., 11th Jan., 1921, with rank of Capt.
McGee, Lieut. W. R. A., M.C., 13th Jan., 1921, with rank of Major.
Neale, Lieut. J., M.C., 14th Jan., 1921.
Royle, Lieut. L. C., 5th Jan., 1921.

Transfers.

Quinnell, Lieut. J. C., D.F.C., to Royal Air Force, 1st Aug., 1919.
Salmond, Lt.-Col. Sir W. G. H., K.C.M.G., C.B., D.S.O., to Royal Air Force, 1st Aug., 1919.
Steel, Capt. J. V., to Royal Air Force, 1st Aug., 1919.

Deaths.

Blandy, Col. W. P. (retd.), at Torquay, 5th Jan., 1921.
Morgan, Capt. T. L., (retd.), at Hereford, 17th Jan., 1921.
England, Lt.-Col. E. P., D.C.M. (retd.), at New Barn, Horwood, N. Devon, 10th Jan., 1921.

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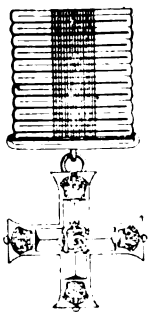

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SOME NOTES
ON THE USE OF AEROPLANES IN WAR.

A Lecture delivered at the Royal Artillery Institution, Woolwich, Thursday, 20th January, 1921.

By Air Commodore R. Brooke-Popham, C.B., C.M.G., D.S.O., A.F.C., R.A.F.

Colonel G. H. A. White, C.B., C.M.G., D.S.O., R.A., Commanding Woolwich Sub-Area, in the Chair.

CHAIRMAN: Ladies and Gentlemen, Air Commodore Brooke-Popham has kindly come down here to-day to lecture us on Aircraft in War. Air Commodore Popham joined up with the Royal Flying Corps in 1912 so that he may be said to be a pioneer of the Corps. He served with great distinction in the War from August 1914 until he was recalled to the Air Ministry in 1919. He is now the Director of Research there so that I think you will agree with me that there could be no one more qualified to lecture to us on this interesting and to the British Nation most vital subject of Aviation. I will ask him to go on with his Lecture. (Applause).

THE LECTURER: Colonel White, Ladies and Gentlemen: The title of this lecture covers a very wide ground, the subject matter is less ambitious. All that I shall do this afternoon is to endeavour to indicate some of the special difficulties and possibilities of aircraft in the hopes of assisting you in drawing deductions as to their use in the future.

I shall confine my remarks almost entirely to aeroplanes and not touch on airships owing to want of time.

First I wish to remind you of certain elementary scientific facts; everyone knows them but I have often found that people who move only on the surface of the sea and earth fail to realise how these elementary facts affect those who move in three dimensions instead of two.

When we talk of the speed of an aeroplane, it always means speed through the air. The speed relatively to the ground depends entirely upon what the air is doing at the time. If, therefore, the aeroplane has a speed of 60 miles per hour, and is moving east and there is an east wind of 60 miles per hour, the aeroplane will be stationary relatively to the ground, but if the aeroplane turns round so as to fly with the wind then it will be moving over the ground at a speed of 120 miles per hour, though its speed through the air will be the same in each case. An occupant of an aeroplane who puts out his hand will feel the wind blowing against it in the same direction and with the same force, whether the aeroplane is heading into the wind, travelling with it, or moving at an angle to it.

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If a man is out of sight of the ground he has no means of telling how he is moving relatively to the ground; any instruments that he has, only tell him his speed through the air and unless he knows the force and direction of the wind he cannot tell his speed with reference to the ground.

The next point to remember is that the pressure of the air decreases as one goes up; e.g. at a height of 15,000 feet the air pressure is just half what it is on the ground.

The most important result of this is on the engine. Horse power decreases with height if other conditions remain the same. To take a well known engine that gives 360 h.p. on the ground, at 15,000 feet it will only give 200 h.p. Another way of looking at it, is that an engine that weighs 3 lbs. per horse power on the ground, will weigh 5½ lbs. per horse power at 15,000 ft.

There are various methods of getting over this.

One is to use a very high compression ratio e.g. 6·3 to 1, an average motor car engine being between 4¼ and 4½ to 1. This means that the engine can only be opened full out above heights of some 6,000 or 7,000 ft. otherwise detonation of the charge will occur instead of explosion.

Another method is to use some form of forced induction, so as to force air into the cylinders instead of merely drawing it in. This was the method used on the American machine which reached an altitude of over 33,000 ft. a few months ago. The Germans have also used this system and in one of their machines which we took over under the peace treaty there was a separate engine of 110 horse power driving a large fan to supply the main engines when flying high, the horse power of these latter aggregating about 1,000.

A German report states that by the use of this blower the power of the main engines would be kept constant up to a height of 16,500 ft.

Now one trouble with any method of keeping up the power of engine at heights is the fact that owing to the decreased air resistance the engine finds it easier to turn the propeller round than it did at ground level. Therefore if we make the propeller suitable for the engine at ground level and keep up the power of the latter at heights, we shall find that the engine will turn the propeller so fast that something will break; on the other hand if we make the propeller suitable for a height, the engine will only be able to turn it comparatively slowly on the ground and the machine may never get into the air at all. The obvious remedy is to use a variable pitch propeller and considerable progress is being made with this although no really satisfactory one is yet in use.

There is also an effect on the occupants of the machine. As is well known by any mountain climber when the air pressure is reduced any physical effort becomes exhausting. In addition a species of brain fag frequently develops.

The height at which these effects become serious varies considerably with individuals and in many cases people seem to become acclimatized as it were to reduced air pressure.

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The effects are ultimately due to deficiency of oxygen and the obvious remedy is to make good that deficiency. During the war we used compressed oxygen.

It has recently been decided to abandon this in favour of liquid oxygen.

The next point is the decrease of temperature as one goes up.

The most serious effect of low temperature is on the occupants of the machine. A temperature of minus 20 degrees Fahrenheit, which is not unusual at heights of 15,000 feet, is I am informed the average winter temperature at the South Pole. At this temperature, any metal which is touched with the bare skin will have a serious effect I remember one incident of an observer who for some reason or other touched his gun with his mouth and left the greater portion of his lips sticking to it.

It was found that mere passive resistance to cold was of little real value in these extreme temperatures and eventually we made use of electrically heated clothing.

I might mention here that flying can be carried on in extreme condition of cold. In Northern Russia in the winter of 1918 the ground temperature was sometimes down to minus 27 degrees Fahr. i.e. 59 degrees of frost but flying went on.

The next point is that the wind changes both in force and direction as one gets higher, and this is of great importance for civil as well as for military aviation.

Just to illustrate the importance of pilots studying wind velocity and direction at different heights, take a recent case where the wind was west and had a velocity of 15 miles an hour at 8,000 feet and 87 miles an hour at 16,000 feet, suppose a man is flying from London to Berlin which is practically due east and a distance of say 600 miles, on a machine going 100 m.p.h. through the air. If he flies at a height of 8,000 feet which is not a bad average for a clear day the wind velocity would cause his actual speed over the ground to Berlin to be about 114 miles an hour and he would cover the distance in 5 hours 16 minutes. Now suppose another pilot who had studied the wind direction started at the same time from London on a similar machine but went up to a height of 16,000 feet, he would travel at the rate of about 185 miles an hour and would arrive at Berlin in 3 hours and 12 minutes, i.e. more than two hours before the other man.

To take another instance, where the wind near the ground was 17 miles an hour and E.S.E. and at 16,000 feet was some 30 miles an hour and west. Suppose a pilot flying also on a 100 mile an hour machine from London to Glasgow, a distance of 344 miles under other conditions. He makes a careful calculation and finds that he must fly at a bearing of 338 degrees to go towards Glasgow and that his speed will be about 113 miles an hour. Being a pilot who likes high flying he decides to go along at 16,000 feet instead of at a lower altitude but makes no allowance for the wind changing. Supposing he flies above the clouds without seeing the ground or taking any notice of his drift, he would expect to reach Glasgow in about three hours. He comes down through the clouds then, and, instead of

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seeing the southern outskirts of Glasgow in front of him, sees nothing but the sea all round. He would be some 50 miles east of Newcastle and in the middle of the North Sea.

Pilots cannot afford to neglect meteorology.

I will now just touch on a few special points with regard to the navigation of aircraft. On a clear day the problem is simple provided the pilot has got a map of reasonable accuracy. But suppose he's over clouds and cannot see the ground. As we saw a few minutes ago it is very necessary to start with for him to know the wind direction accurately at the height he is flying. But even given this he will never be certain what part of the country he is over within two or three miles at any rate. Before he left he may have had a telegram from his destination to say that the clouds were 500 ft. up, but by the time he gets there this information may be two or three hours old and the weather may have changed since then. He has no means of telling without external assistance whether the clouds now extend right down to the ground or not and finally he never knows his actual height above the ground where he happens to be. All he has got towards this is an aneroid which simply tells him the barometric pressure. It will certainly indicate fairly accurately the height above the point whence he started, but the country where he is may be at a higher level than his point of departure. He may think he is over his destination but actually be five miles away and over a high range of hills. What happens then? He comes gaily down through the clouds seeing nothing remember, thinking he has still 1000 ft. to his credit, and the first intimation that he has of that hill is hitting it at some 80 or 90 miles an hour.

Its a very nasty feeling coming down through clouds. A very thorough system of ground organization and signals seems to be the best solution for this problem, but what would be of enormous assistance is an instrument that would indicate the true height above the earth.

Let us now consider actually flying in clouds. This introduces many other complications. In every other case a pilot has got some reference point to guide him. It may be a portion of the ground, a cloud horizon, or the sun. Any of these will help him to keep his direction but if he is actually flying in a cloud he has no external assistance. Everyone knows how difficult it is to keep a true direction when walking through a fog. Most people after walking in a fog for some time find themselves going in circles. It is exactly the same in the case of an aeroplane in a cloud. After two or three minutes all sense of direction is lost but in this case it is not a question of merely going round in a circle on the surface of the earth, one has got to bring in that third dimension, and unless the pilot has some instrument to help him, he will lose not only all sense of direction but also all sense of vertical and horizontal.

There may be pilots who can fly in clouds without instruments but I have never met one. In the days when we had no instruments the aeroplane generally got completely out of control in a cloud and it was a frequent occurrence to emerge from the cloud apparently flying straight into an immense vertical cliff. It was not until one saw

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trees or houses sticking horizontally out of this cliff that one realised that the cliff was really the ground and that it was oneself that was vertical.

The pilot must depend entirely upon instruments; these exist but the trouble is that with the three dimensions to consider the pilot has too much to do. The only real solution to my mind is to relieve him of the responsibilty of controlling the areoplane in more than two dimensions by making it perfectly stable in one or having one or more of the controls actuated directly by some automatic apparatus. I do not think any modern machine is sufficiently stable to control itself even in one dimension in a really bad cloud, as these are notoriously full of bumps.

During the War machines improved out of all knowledge as regards their fighting and warlike qualities generally, in such points as manœuvrability, facilities for view, ease of handling the guns, and indeed the possibility of firing from the aeroplane at all.

Also the performance i.e., speed and rate of climb, was doubled or trebled, but this was not obtained by any real increase in the aerodynamic efficiency of the machine. It was really done by brute force; all we did was to pile bigger and bigger engines into the machines and drag them along by great speed. It requires very nearly the same amount of horse power to drag a given weight through the air at a given speed as it did at the beginning of the war. This is rather a disappointing admission to make but it must be attributed largely to the exigencies of the War.

During that period, money was of little consequence but time was all important.

We could not afford to lay firm foundations and build up steadily on them, but had to go straight to the solution of a definite problem, in the hopes that one of the many methods we were trying out would prove satisfactory. It was in fact a process of trial and error on a large scale.

There is however a limit to this process and it must be realised that application in aeronautics has got a long way ahead of research and that it is now necessary to make good this leeway. It will not be done without the expenditure of much time and labour and people must realise that it will be a long time before we get the foundations firm, still longer before we can build on them.

As a rule one only sees the result and thinks that some marvellous improvement is invented in the course of a few hours, or possibly days; people seldom hear of or if they do, get bored with, being told about the patient researches, numerous failures, the time and money which had to be expended before the result was reached. It is no good waiting until the results are wanted before beginning the experiments, if one wants improvements in five years time one ought to start now.

Aeroplane squadrons are expensive items to keep up under the strenuous condition of a European War and the wastage of aeroplanes is very heavy. During the last 18 months of the War, the average wastage was 51 per cent per month, i.e. all the machines with squadrons in France had to be replaced once every two months or six times a year. In other words each machine only lasted an

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average of 60 days which would mean a little over 60 hours flying per machine.

This is only the average. One machine did 440 hours flying in France and was then flown back to England. This by the way was an R.E.8. a type of machine that at one time got rather a bad reputation.

Of course, considerable use was made of the machines that had to be replaced. Large numbers were reconstructed in France and others were reconstructed in England and in any case they were dismantled for spare parts, but as regards squadrons, replacements were required at the rate I have mentioned.

The wastage known to be due directly to enemy action never reached 25 per cent. To that should be added a proportion of the missing machines but even adding these in, it is very doubtful if the wastage due to enemy action ever amounted to more than a third of the total losses. The wastage due to errors of pilots varies. Whenever we had heavy casualties in pilots it meant that a large batch of new pilots came out from England, they were unused to the country and lacking in experience, consequently a heavy casualty list in pilots was generally followed by a large increase in the number of aeroplane casualties due to errors of pilots.

This heavy wastage means keeping a very large reserve in order to ensure that casualties are replaced at once, and this is complicated by the fact that we always had a large number of different types of both machines and engines out in France.

Of first importance in connection with the upkeep of aeroplanes is the supply of spare parts. An Infantry soldier can still be of considerable use as a fighting man even if he is deficient of certain parts of his equipment, for instance, if he has lost his water bottle his efficiency is not seriously impaired, but the matter is very different in the case of aircraft. The failure of one small bolt may convert a whole aeroplane from a valuable weapon of war to a useless encumbrance on the ground. During the War we seldom had any particular type of aeroplane long enough even to say what particular part was likely to show weakness and to require replacing first, and it is of course quite impossible to say what particular form of bad landing a pilot may make and thus what particular part of the machine he may damage and still more what particular part of a machine may be hit by an enemy bullet.

Therefore we always had to be ready to replace any and every part of an aeroplane and have a large stock of each part ready for issue to squadrons.

Apart from the material necessity for keeping squadrons up to strength in machines there is the moral effect on pilots to be considered. Quick replacement of casualties is the most efficient method of restoring morale after heavy losses, and in the case of the Air Force it is just as important to keep units up to establishment in aeroplanes as it is to keep them up in pilots or observers. A squadron's morale will soon begin to drop if instead of being able to send 18 machines up into the air as it should, it has only got a total of 12 of which about half are out of action for want of spare parts.

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It is therefore of the highest importance that spare machines and parts of every sort shall be instantly available. This means large Base Depôts and an efficient channel of supply between Depôts and Squadrons, and on the sound working of this supply system, the efficiency of the Air Force in any theatre of war, very largely depends.

I might add that these wastage figures are for European War conditions and will be less in small wars.

I will not weary you with details as to the performance of modern machines but will merely remark that a modern single seater fighter will climb at a vertical rate equal to the speed of a fair sprinter over 100 yards, that its horizontal speed is about 2½ miles a minute and that a modern bomber can drop over half a ton of bombs at a point a good 350 miles away and return to its starting point. We are about to place orders for a bombing machine that will drop 1,000 lbs. of bombs about 550 miles away from its starting point and return. It might be interesting to note that if a squadron of these machines were stationed at Famagusta in Cyprus it would be able to bomb any part of the Bagdad railway from Constantinople to Mosul both inclusive.

I want now to consider briefly a few broad points in connection with the employment of the Air Force with the Army, the Navy, and on its own.

Work with the Army is so familiar to most of you that it is hardly necessary to say anything about it, but I would draw your attention to the fact that R.A.F. squadrons form an extraordinarily mobile reserve. They can assemble in one area in a few hours and can also concentrate their efforts on one spot without the necessity of previous movement, thus enabling surprise to be effected easily.

I should like also to draw attention to the necessity for all officers being able to understand aerial photographs. These, like maps, are of little value unless the recipient is practised in reading them. We were taking photos on the Aisne in September 1914 but as nobody seemed to understand them, they were not wanted and so we never really got down to photography till some months later, which was unfortunate.

Air photographs may often be of great value as indicating the enemy's intentions. I have a rather interesting photograph showing a practise trench which the Germans had constructed several miles back. It was part of our lines and gave away their probable point of attack weeks before it took place.

Photographs we took in September 1918, showed the beginnings of a German defensive line, many miles back.

For those who wish to know what aircraft can do by way of direct assistance in a battle I recommend the study of General Allenby's battle in Palestine in the middle of September, 1918.

It is the one case in the whole war when I really think either side may be said to have got command of the air, though even here it was temporary and very local.

It was obviously of great importance to conceal the concentration on our left and the movement of the bulk of the cavalry from our right. This was satisfactorily effected by our machines sitting over

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the enemy's aerodromes and attacking any machine that attempted to leave the ground. I believe one hostile aeroplane did come over our lines but as it took back misleading information no great harm was done. The following extract from a captured report shows how low the morale of the German Flying Corps had sunk:—

"The loss of two more machines of the 301st Flight compelled the suspension of all reconnaissances in front of the VIII Army. An attempt will be made to continue flights on the remainder of the front occasionally."

Before the battle commenced we bombed Deraa Junction, El Afule another centre of communications, and the Headquarters of two Turkish Armies at Nablus. El Afule was bombed by a Handley Page that had just arrived by air from England. On the morning of Sept. 19th a squadron was specially detailed for the systematic bombing of all the telegraph and telephone exchanges and the enemy's communications were practically put out of action.

Then in the actual attack on the Turkish right flank the Air Force did very useful work in bombing the parties of Turks retiring to their second line of defence, with the result that the enemy never occupied it at all but went away north-east leaving the coast road open to the cavalry.

The Turkish lines of retreat were very few, well marked and mostly defiles, and the Turkish columns moving along them were continually bombed. Now the cavalry had by Sept. 20th got right round the Turkish flank and was blocking their lines of retreat to the north at El Afule and at Beisan. But there was one road still open leading east across the Jordan at Jisr ed Damieh. Reconnaissance machines fitted with wireless were detailed to watch the road. On the morning of 21st Sept. the head of a big Turkish column moving east was seen approaching a gorge. A wireless message was sent to Air Force Headquarters and every machine that could carry bombs was turned on to bomb the head of the column. Having completely blocked the road through the gorge the aeroplanes then proceeded to attack the rest of the column at their leisure with machine guns and bombs. The chaos was indescribable and half the column disintegrated. The rear of it turned off north towards Beisan. It was pursued by infantry and its escape was blocked by the cavalry, but the actual attack on it was carried out by the Air Force. This body also broke up abandoning its arms, guns and transport. 87 guns were found along one stretch of five miles of road.

It is a very striking instance of the morale and material effect that can be caused by aircraft during a retreat, if such retreat takes place by day and if the winning side is in no way hampered by hostile aircraft.

I remember reading some time before the war I think in *Punch*, a skit about an examination for tactical fitness, when the Board gave the following problem to the unfortunate Major.

You have infantry and guns in front, cavalry on the right, a morass on the left, and aeroplanes over. Describe your next step giving reasons.

Some six years later, that was translated into grim reality with the further complication that the Turkish Army had cavalry in rear

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of them as well. I do not recall what the Major's answer was, but in 1918 the C.-in-C. of the Turkish Army, (Von Sanders) took his next step without waiting to give any reasons; it was a very rapid one all by himself, in pyjamas, and a motor car.

Aeroplanes were often of great indirect assistance on the Western Front by dislocating the enemy's Lines of Communication just before or during a battle and thus preventing him running up reinforcements, food and ammunition, etc., by actual destruction of ammunition dumps.

Thionville junction was successfully bombed on the 16th July, 1918, and at the risk of boring you I should like to read you some extracts from the German account of the occurrence.

A munition train, which was standing on track No. 7. in the centre of the Thionville Urban District, received two direct hits. Fifteen trucks at once exploded and caught fire. Shells contained in the trucks exploded at intervals. An additional 5 trucks which were stationary in the unloading sidings also exploded as well as one truck containing S.A.A.

Exploding shells then set fire to the express goods shed.

West of the goods station sheds on the other side of the road, stand two buildings. One of these, the most southerly, contained loose shells stacked in heaps. These were exploded which set fire to two buildings just N. of it containing hand grenades and S.A.A. This exploded and burnt out.

By this time assistance was useless and the trains and buildings were left to burn themselves out.

Despite the co-operation of two motor fire engines belonging to the military fire brigade, it was impossible to save the trucks or buildings. The despatch offices and goods sheds were completely destroyed.

The total casualties in personnel amounted to 83 German military killed or wounded and 10 civilians killed.

The public went to earth in cellars at 2 p.m. and did not dare to come out till after dark. Needless to say the moral effect was prodigious and few inhabitants of Thionville will ever forget the 16th July.

Then another point often overlooked is the amount of man power and material that is absorbed in the endeavours to obtain protection from aircraft. I refer not only to active defensive measures such as anti-aircraft guns and aeroplanes withdrawn with their personnel from the area of land battles, but also to the many shelters of an elaborate nature which the Germans constructed, more particularly in Belgium.

One of the best known is the submarine shelter at Bruges. The work consists of eight shelters each of which measures 26 feet wide and 220 feet long. The whole thing was built of ferro concrete and it was entirely roofed over, the thickness of the roof being 4 feet 3 inches.

The total height from the bottom of the foundations to the top of the roof was 65 feet 6 inches.

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Imagine the amount of man power, transport facilities and material that must have been diverted from the firing line to prepare this enormous shelter.

This seems something like a fore-runner of the bomb proof harbours we have read about in the "Times" recently.

In the next naval battle I believe that air observation of fire will be every bit as important as it was on the Western front on land. In fact it seems as if this question will be the governing factor in victory or defeat where the opposing forces are in any way equally matched.

The observing machines will be carried in special aircraft carriers and will get off from and alight on their decks.

Aircraft are also a very effective form of defence against submarines and the Germans seem to have been more afraid of our seaplanes and their bombs than of anything else.

In this connection the figures for the flying boat squadron operating from Felixstowe may be of interest. I give them for the 12 months beginning April 1917.

Their average strength in flying boats was 8. During the year they lost two machines from hostile action and nine were struck off for other causes. Total losses in personnel, eight killed and four interned.

They bombed 25 German submarines and as far as I can make out sank 5. As regards the fighting therefore, this gives 2½ submarines for every flying boat and even allowing for some degree of optimism the balance is still well on our side. Incidentally they also brought down one Zeppelin, L.Z.43, and three hostile seaplanes in the same period.

I am not able to answer Sir Percy Scott's question, "what is the use of a capital ship," but I can state that aeroplanes cannot to-day attack a modern capital ship with any hope of success.

We have got torpedo carrying aeroplanes and they could I feel confident do very good work against small cruisers or even against older types of larger vessels, but at present they can only carry a 18" torpedo weighing 1000 lbs., and a ship like the *Hood* can stand at least two 21" torpedoes and still go on fighting. But our facilities for attack are improving rapidly and there may be a very different tale to tell in five years time or even less.

There seems more hope from a bomb at the present time and it seems probable that two or three of our big 1650 lb. bombs may make a nasty mess on the deck of any ship.

Now there are certain conditions under which the Air Force may be able to operate independently even at the present time.

The fact that aeroplanes can operate off the deck of a ship, opens up enormous possibilities for dealing with many of the small wars in which this Empire indulges so frequently, provided the objective is within say 200 miles of the sea or a navigable river. What generally happens is that some tribe carries off the women and cattle of some tribe under our protection or that a missionary party is killed and eaten. After due preliminaries and failure to obtain any apology, an

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expensive expedition is fitted out and after a lapse of some 18 months or so it either gains or fails to gain its objective. Even in the former case, the tribe that committed the enormity has probably forgotten all about it by the time the expedition gets there.

Now supposing we had distributed in strategic points about the world a few of these aeroplane carriers each fitted up with about 20 machines and an adequate supply of bombs, petrol and spares. Within a few hours or at any rate a few days of a missionary being eaten the aircraft carrier could have reached some convenient point near the coast or up a river, no harbour wanted, no railways, no supplies of any sort, all is entirely self-contained. The next morning off go the twenty aeroplanes loaded with bombs and before our cannibal tribe has recovered from the effects of indigestion they find a speedy vengeance descending from the skies.

It seems to me a very rapid means of settling the dispute and economical in men and also in what appears to be more important at the present moment, money.

Then another little point, it is often very hard to decide on the objective in small wars. There may be no king to conquer, no capital to occupy, no organised army to overthrow, but as Colonel Callwell says in his book on small wars, if the enemy cannot be touched in his pride or his honour, he can be touched through his pocket. Here it seems to me aeroplanes have an enormous advantage. When a tribe hears of a land expedition elaborately organized and entering their country by slow and painful stages, they can collect their cattle, their flocks, their horses, and take them off to some quite inaccessible spot, and keep them there until our expedition is forced to retire. But with aeroplanes there is no such thing as an inaccessible spot, there is no place to which he can remove his source of wealth, which cannot be reached.

As an instance of this possibility I should like to remind you of the recent campaign in Somaliland which commenced in January, 1920.

The despatch by the Governor of Somaliland has recently been published and here is an extract from it:—

> "In my previous despatch I explained the causes of the steady decline of the Dervish power during the last six years; and 23 days of active operations, from the 21st January to the 12th February, have now sufficed to effect its final overthrow. For this the credit is primarily due to the Royal Air Force, who were the main instrument of attack and the decisive factor. They exercised an immediate and tremendous moral effect over the Dervishes, who in the ordinary course are good fighting men, demoralizing them in the first few days. There was thus no serious opposition and the operations assumed, almost from the start, the nature of a hunt. Our casualties among troops were confined to three native ranks killed and eight wounded; and one officer of the Camel Corps was slightly wounded. Neither the Royal Air Force nor the Royal Navy suffered casualties."

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This result from the point of view of economy in personnel and, I might also mention, economy in money, is most remarkable, and seems to open up great possibilities for the future.

The Mullah's camp at Medishe was set on fire by aeroplane bombs, 21st January, 1920. It may be noted that at the time it was first bombed the aerodrome was over 100 miles away. The story goes that the Mullah, seeing the aeroplanes approaching and having called together all his followers, stood outside his tent leaning on his uncle's shoulder and exclaimed: "See the very angels are being sent down from Heaven to fight for the true prophet of God against the unbelievers." At that moment the first bomb dropped, killed his uncle and nearly killed him. History is silent as to the exact words the Mullah then made use of.

It may also be noted that as the enemy in small wars will in all probability have no A.A. guns, our machines will be able to come much lower before dropping their bombs than in the case of a big war and will be able to make correspondingly more accurate shooting.

In future big wars aircraft will also have an important independent role.

Under modern social conditions control of policy rests finally with the mass of the populace of the nation. No civilized country can enter on a big war now, unless the whole nation is in favour of such a course. The question of victory or defeat does not rest solely with the fighting services, but to an ever increasing extent on the national morale.

This morale may be adversely affected by:—

(a) Propaganda.
(b) Sickness.
(c) Starvation.
(d) Fear of personal injury.

The distribution of propaganda or germ may be effected by aircraft but can be distributed by other means than aeroplanes.

Starvation may be impossible and is certainly slow in action, but the last cause, Fear of personal injury, may be brought home to the enemy nation the first day of the war and before any military or naval forces leave the country.

A small start was made in the last year of the war by the Independent Force, operating from Nancy, and though it suffered from many disabilities it was able to accomplish something.

I have a picture from a German illustrated paper, depicting a mighty warrior advancing on some small and terrified civilians. It is not as you might expect the virile Teuton crushing all resistance before him, but the harmless Prussian peasant about to get it in the neck from the brutal British Air Force.

In the same connection, the following extracts from captured letters may be of interest.

Here is one written from Stuttgart on August 4th, 1918, just after an air raid:—

> "The fifth year of the war has commenced and indeed commenced in such a way that one thought that Hell had opened

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in the night. One cannot help thinking that God must have completely withdrawn his protecting hand."

This was a remarkable admission for a German to make.

Another is dated Offenberg, 30th January, 1918:—

"Last week just as I was going to bed, the siren began to bark and in a short time, bombs began to fall. The anti-aircraft guns then opened fire. I don't know to which further Saint I ought to pray."

The interesting part about this letter is that on the date it was written, no bombs had been dropped on Offenberg at all, either by us or by the French.

A third, dated Griesheim, 27th November, 1917:—

"We had a terrible explosion at the Chemical Factory on the night of the 20th. November. The whole population had to leave.

Anna said to me, 'Get up, I have just heard the siren.' Suddenly, I saw the whole sky as if on fire. I cried out 'God in Heaven have mercy upon us.' Hardly had I said these words when there was a loud explosion and every single window was broken. I ran as far as Frankfort and returned the next day."

In view of the fact that the distance from Griesheim to Frankfort is over 20 miles, you will agree that the moral driving force that induced such a physical effort must indeed have been considerable.

Five minutes more, Gentlemen, and I have finished. There is one thing we are often encouraged to do and that is to think ahead and there is nothing more difficult. Of the importance of it from a military point of view there can, of course, be no question. Think, for instance, what would have happened if the divisions that crossed to France in August 1914 had been equipped in the same way as a division in the middle of 1918; the Expeditionary Force would have walked to Brussels either after or with Von Kluck instead of moving somewhat hurriedly in front of him towards the Marne.

What we want to do now is to equip our present fighting forces as far ahead of the present day as the 1918 division was ahead of the 1914 one.

Looking back with our present knowledge there seems very little reason why a really intelligent brain with good imagination and scientific and mechanical knowledge should not have been able to forsee most of the developments of this present war. To take the case in which I am most interested—aeroplanes—several of us realised as far back as 1911 the importance that air fighting would have in future wars, but we never carried this to its logical conclusion and had aeroplanes designed purely and simply for fighting purposes; the result was that the aeroplanes we took across to France in August 1914 were built in such a way that it was practically impossible to fit a gun in any of them. If we had had a squadron of modern single seater fighters we should have driven the Germans out of the air in a few days. Similarly with regard to artillery co-operation; there was actually a report sent in about

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September 1912 drawing attention to the great value of observation of artillery fire from aircraft and adding that it could never be made really effective until aeroplanes were fitted with wireless. Again this proposal was never carried out and the result was that only two of the aeroplanes we took over to France had any wireless on them at all and we never got any move for 3 months or more. I think that the real reason for this lack of progress lay chiefly in the fact that the individuals who were directly connected with the matter and who realised what was or might be possible, were so engaged in routine matters, so busy coaxing aeroplanes into the air and training pilots to bring them down again without crashing, they had very little time to think matters out to their logical conclusion and indeed hardly thought it their business. What I feel is that if there had been some small body of men who could have been kept in close touch with mechanical and scientific developments and whose job had been to visualise their possibilities and to think out what their use in war would necessitate, the 1914 squadrons would have been equipped not very differently from the 1918 squadrons. Ought not we to apply those lessons to the present day? I quite agree that finance comes into the matter a good deal but it is not the only difficulty nor do I believe that it is the main difficulty. What we really want is a set of men with imagination and clear logical brains to think things out and I might add that this is not an easy matter to do in a government office with one's In Trays overflowing with papers, many of them marked "Urgent."

One other point about looking ahead; one of the great difficulties of the last war was getting the civilian industries in this country turned over to war production. Won't it be the same in the next war unless some steps are taken now? Time was on our side in the last war and we were able to wait the two years that it took before war production on a large scale really started, perhaps in the next war time may be against us, there may be an urgent necessity to get war production going at once. I do not know how this is to be done but it ought to be thought about. I wonder whether anyone is?

REMARKS.

CHAIRMAN: If anybody would like to ask the Commodore any questions about the Lecture he will be very pleased to answer them.

Well I am sure we all want to thank the Lecturer for his very interesting Lecture. I wish I knew more about Aviation myself. It is always an unfailing source of admiration to me the way these fellows carry on. Everybody knows we were top dogs at the end of the War and it is up to us to see that we do not lose that position. I suppose it is a mere platitude now to say that every future European War will be a war of nations, not only a war of armies, so that the time when paterfamilias would sit at his breakfast table and munch his toast and read about the war and say "It is all very well for these soldiers to carry on," and then go to his office, is over. It is going to touch everyone of us the next big war, because we shall get it in the neck wherever we are, sitting in our offices or in our

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breakfast rooms, or wherever it may be if we do not take steps to prevent it. Therefore it is of course of the greatest importance that everybody who has got an inventive brain should use that brain to the best of his ability. We have got the brainiest fellows in the world and we have got as good machines as anybody in the world. Unfortunately we are a bit short of cash I suppose just now.

We have been told by the Lecturer that during the War time was of every importance, and money was of comparatively no importance. Unfortunately the position is now reversed and we all know that it is like drawing teeth to get a bob for anything, and still it is I am sure the very falsest economy to skimp expenditure on the Air Force, because if you are piling up cash in other ways you are only going to give it to the Hun, or some other enemy who will come over and take it some day if you have not got sufficient preventive measures to put against him; so that I think that everybody who has the brain to develop those ideas should do so and as the Lecturer has very pertinently said, if these brains had been applied in the most efficient manner in 1914 it is quite possible that the War might have been very much shorter than it was.

I was glad to hear the Lecturer touch on the matter of Civil Aviation because I rather wanted to know something about it, in fact I would rather like to know a little more about what the Government is going to do in that way because I take it that it is just as important to encourage civil aviation as it is, or at all events it was, before the poor old horse became so unfashionable, to encourage horsebreeding for the supply of horses for the Army. The two things go more or less on parallel lines, so that I hope the Government is going to provide a bit of cash for that anyway: Are they, do you know?

AIR-COMMODORE BROOKE-POPHAM: £60,000 next year is the amount of the subsidies.

CHAIRMAN: We can only say that we are very grateful to Commodore Brooke-Popham for the Lecture, and for coming down all this way to give it to us. I am sure you all agree with me.

(Loud and continued applause).

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THE SUPPLY OF SIGNALLERS FOR R.G.A. BATTERIES.

BY CAPT. R. D. TUOHY, R.G.A.

DURING the War it was found that a very large number of Signallers were required for Heavy and Siege Batteries, perfect communications being all important for this nature of Artillery.

Several large Schools of Instruction were created to supply these signallers, both to new Units and reinforcements.

Men of good education were picked out at the Depôts, as they were called up, and sent to these Schools, and it was found that, as regards reinforcement signallers, they could be trained in three months. These Schools have been reduced.

One advantage of this arrangement was that standardization was possible, an important point in the training of signallers.

The knowledge required of the modern Artillery Signaller is considerable and may be tabulated as follows :—

Morse.

Flag. Lamp. Buzzer. Heliograph. Fullerphone. Wireless.

Semaphore.

Flag.

Telephony.

The operating and adjustment of ringing and vibrating telephones and exchanges. Line work.

Miscellaneous.

Map Reading. Despatch Riding.

It is presumed that the Artillery will have to find their own Wireless Operators in the future.

The difficulties of getting the necessary number of signallers and of giving them a thorough standard training in all the above subjects, under Battery conditions, with R.G.A. Batteries at their present strengths, are well nigh insurmountable.

Other Specialists can be trained "when you can get them" but the Modern Artillery Signaller requires a continuous course of instruction extending over a considerable period.

It is difficult to induce young soldiers to become signallers, and when it is remembered that 30 signallers per Siege Battery were not found too many in the war, it will become obvious that, in the majority of cases, the present shortage is acute.

To meet this shortage a scheme is required which will offer some inducement to the recruit to become a signaller, and which will ensure the necessary period of continuous training.

Any details as to organization, numbers under instruction etc.— have been purposely omitted, as also any consideration of this scheme with reference to the Coast Defence Units of the R.G.A. or to the Territorial Artillery.

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The following suggestions are made :—

1. A Training School for signallers to be formed at Home, as part of one of the Reserve Brigades, preferably that at Fareham, where accommodation exists, the country is suitable and the surroundings pleasant. This arrangement does away with the necessity of a separate Administrative Staff. Only the Signalling Instructors being additional to the establishment of the Reserve Brigade. It also forms a nucleus which will permit of expansion in war.
2. The men will be obtained from volunteers.
   (a) Among the recruits as they join at the Depôts.
   (b) Among the personnel of existing Batteries (a temporary measure).
3. The course to last 12 months—and to be such that the finished product should be not only a signaller but an Artillery Signaller i.e. when he deals with a technical message he knows the meaning of it—and has a practical knowledge of gun drill and Fire Discipline. The course to include participation in practices at the School of Artillery or elsewhere. The following should be included in the training, as in addition to ranking almost as necessities for the signaller, they will help to make the course more attractive.
   Equitation.
   Musketry.
   Riding and running repairs to Motor Cycles.
4. The soldier to receive his Proficiency Pay as soon as he classifies as a signaller, and to be allowed to classify after he has completed six months at the school. but to complete his 12 months in any case. Week end leave to be granted freely to men who make satisfactory progress.
5. Two months furlough to be granted to every soldier who completes the course satisfactorily.
6. The fact that a soldier is a signaller not to be allowed to interfere with his chances of promotion.

Under the above conditions it is to be expected that the necessary number of recruits will come forward for training as signallers— it being taken for granted that it is not possible to make a man a signaller against his will.

The withdrawal of men from Batteries to undergo the course should be contingent on their passing a preliminary test in signalling, with their Units. This process would cease automatically after a time, as in future no man will be allowed to come to the School from his Unit after having refused the opportunity while at the Depôt. Finally it is suggested that a proportion of young Officers could undergo this course with advantage, subsequently proceeding to the Army School of Signalling to obtain Instructors Certificates, if they wished to; and that the school should be able to grant Assistant Instructors Certificates to Artillery N.C.O's the examination therefor being supervised by the Army School.

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CO-OPERATION BETWEEN LIGHT AND MEDIUM ARTILLERY IN THE DIVISION.

BY LT.-COL. C. F. PHIPPS, D.S.O., R.G.A.

IN the military life it is always the expected which does not happen. At the time of the armistice the future organisation of the Regiment appeared so obvious. One branch for all who deal with land guns; all to be skilled in using guns to the advantage of the other arms, the subaltern after his kind and the general after his kind. One artillery authority to whom the infantry commander at his headquarters can turn; one artillery authority with the front-line company, knowing which guns to use and how to use them.

No more field artillery or heavy artillery—Just *guns*!

Such was the dream. It is nobody's fault that it has not come true yet. The difficulties of amalgamation are grave and weighty, and to those who have to deal with them we take off our hats, with a gesture of respect and commiseration.

The question now arises—"If we are to remain in distinctive branches, are not more distinctive names required for these branches?" It is true that the letters R.F.A., R.G.A. are hallowed by glory and sacrifice, but we have never been quite satisfied with the singularly unmeaning word "Garrison". The difficulty is to invent a title which shall embody the ideas of both heavy and pack artillery. The thing "does not say itself" in English.

Certainly, we might turn to the classics and select one Sisyphus as recalling the ideas of *weight* and *hills*. Sisyphus was condemned to roll a heavy stone up a steep hill continually. But whether it was that the proper stores for this shift were deficient owing to "its not having been stated on the indents for what purpose these stores are required, please", or whether it was that he was put off by someone watching him and complaining of his lack of mobility, the fact remains that, every time he neared the top of the hill, the stone took charge and rolled back over the *khud*.

But this gives us no name. The more you think of it, the more certain you become that "Royal Artillery" is the best distinctive term for all branches. It is difficult to see what objection there could be (even if amalgamation be indefinitely postponed) to speaking of the 1000th Field Battery, Royal Artillery, as we used to, or of the 1000th Heavy Battery, Royal Artillery, or of the 100th Pack Battery, Royal Artillery, or of the Umptieth Heavy Brigade R.A. etc. Lt.-Col. Vandeleur has worked out the whole thing in the December number of the Journal.

If this is not distinctive enough for anyone, we can only remark—

"If things aren't split enough for this young man,
"Which are split enough for you and me.
"Why, what a very singularly split young man
"This split young man must be!"

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However, to get beyond names. It is important to remember that, although our bodies may be interned in one or other "branch" for life, yet for our *minds*—"Stone walls do not a prison make, nor iron bars a cage", and in our minds we are free to consider all land guns as guns pure and simple, unfettered by preconceived distinctions of class or rôle. We know that a medium field gun may be used in collaboration with a light field gun in order to accomplish a definite task. We have to consider how the separate organisations which control medium and light field guns can work together to the best effect.

Now the primary misconception, of which we must get rid, is that the use of any particular type of piece is limited by certain arbitrary rules which are dictated by its weight, range and so on. I mean that some people say, "Here is a heavy gun with a long range, let us therefore use it to shoot at those targets only which are at long ranges". Or, "Here is a howitzer firing a heavy shell, let us therefore use it to shoot at houses."

This is putting the cart before the horse.

Rather should we say—"Here is a task which I have to carry out, or a variety of tasks; let us choose those guns, or combinations of guns, which will best carry out the task or tasks."

We are free, if we think the situation demands it, to have more medium than light guns in the advanced guard; to shrapnel an enemy's battery with an 18-pdr. at a range of 7,000 yards, while our 6″ Howitzers shoot enemy infantry with 106 fuze at 5,000 yards.

If a sportsman goes out expecting a mixed bag; if he knows that he may meet anything from a snipe to an elephant, he does not advance, shot gun in hand, followed at some distance by a shikari bearing an elephant gun and other weapons. When charged by an elephant, does he loose off his shot gun and remark—"I perceive that I have failed to stop this animal, send back for my elephant gun"?

If a snipe gets up at a considerable distance, does he say—"Give me my express rifle and I will harrass that snipe"?

No! He will not use his weapons according to any rôle dictated by range and weight, but according to the fire effect which he wishes to produce on a particular target.

And, in anticipation of all possible tasks, he will arrange to have his various weapons all ready to his hand.

This is where we have so often gone wrong in the war, and the reason is not far to seek. It is our organisation. The man who owns the light artillery, does not own the medium artillery. He may decide that for some task he wants medium guns but he has to get them from someone else, which takes time: so he can scarcely be blamed if he decides to do his best with what he has got.

Logically, a Divisional Artillery Commander should have some divisional medium artillery under him. But we have got to deal with actualities, and actually our present establishment of medium brigades of the field army is very small. And the fewer the guns on a front, the more important becomes concentration of fire in comparison with distribution of fire. It may therefore be argued that better use can be made of medium brigades by retaining them as Corps Artillery, and attaching them to divisions as may be required on

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occasion in moving warfare. Let us assume that this will be the organisation.

The problem then becomes—Given a medium brigade attached to a Division and subject to be required at any time for Corps tasks; and given the fact that neither the Div. C.R.A. nor his artillery brigade commanders have served in any rank with medium artillery; and given that the medium brigade commander has never served with light artillery, how are we to obtain the best co-operation?

Well, in the first place the medium brigade must at any given time belong absolutely to one authority or to the other, to Division or to Corps. There must be no simultaneous dual control. In our offensive in 1918 the medium brigade commander had both Division and Corps whispering soft nothings in his ear. He felt that—

"How happy could I be with either,
Were t'other fair charmer away?"

Secondly, however he be administered, he must have his own transport under his own command. A brigade whose whole transport is employed to draw ammunition for Corps, ceases to be a tactical unit. It must have at least enough of its transport to be able to move its guns, and a certain amount of ammunition, at any moment.

Unless these premises be granted, the problem is insoluble; assuming that they are granted, let us get on with the co-operation.

Now, there are two ways in which the Divisional C.R.A. may use his medium brigade.

(A) As a brigade under its own commander.

(B) By splitting it among the Div. Artillery Brigades and forming mixed groups.

In either case there are some things which every artillery commander ought to know.

(1) *Mobility.* A horse-drawn medium battery (60-pr. or 6″ How.) can with ease accompany infantry on the march. Normally it can also march with a column of light artillery at the increased pace at which the latter moves when without infantry; in very hilly country it may not be able to go the pace.

An M.T. battery can do the same as regards its tractors, which indeed are capable of faster movement than the ordinary speed of light artillery on the march. But its lorries cannot go at so slow a pace as infantry.

(I am dealing with actualities and not considering any future and more optimistic M.T.)

(2) *Action.* In moving warfare, without artificial platforms, the work entailed in pulling round the trails of guns and howitzers to deal with line corrections is so heavy, and therefore so slow, that to lay out the initial line with extreme accuracy is a saving, and not a waste of, time.

(3) *Distribution.* A detached section of medium guns or howitzers in moving warfare is not a reasonable proposition. It takes three or four of these pieces to do what is generally expected of two, owing to the same difficulty about switches.

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The trails bury themselves in the ground, and frequent switches become an impossibility. Not less than three or four guns should be detailed together.

(4) *Positions.* Of the positions possible for medium batteries, about 80 per cent are suitable for four guns, but not for six.

(5) *Fire effect.* The fact that a gun has a long range should not obscure the equally important fact that it is more effective at medium than at long ranges.

(6) *Classification.* The words "Heavy" and "Siege", as applied to medium batteries, have no distinctive meaning at all. 60-prs. and 6″ How. batteries can both be classed as medium artillery; both can be used either with horse or with mechanical transport; their establishments in men, horses, wagons, or lorries can be almost identical. If used with horse transport, they both require for officers, Nos. 1, battery staff, shoeing smith, etc., as many horses as does a light field battery, except that "coverers" are not essential, and "B Group" signallers need not necessarily be mounted. With M.T., if they are to be mobile, they require either these riding horses which we have mentioned or else some form of Light M.T.

The 6″ How. is a lighter weight behind the team than the 60-pr., but a more awkward weight than the marks of 60-pr. carriage which allow of the gun being carried in a travelling position.

It is necessary to emphasise such points as these batteries were originally raised, in the war, as separate classes of batteries and their personnel kept distinct. All such distinctions have vanished now and it is agreed that batteries should not be classified according to their transport. Provided the mobility is there, it does not matter if it be obtained by horse or by tractor.

What are the advantages of the medium brigade working under its own commander? As we have already said, the fewer the guns, the more important is concentration of fire; and concentration will be very difficult to obtain if batteries are divided up among the divisional Light Brigades. The infantry will most certainly demand counter-battery work and that will not be possible unless the medium batteries, or most of them, are under one commander. Having exorcised the demon of dual control we must not raise him again. Everyone will agree that several mixed groups on a division front, each doing its own counter-battery work, as well as its own infantry work, is not a practicable proposition.

Can the arrangement be to have, say, two mixed groups for infantry work and one mixed group for C.B. work? Well, the C.B. group will surely require at least three of the medium batteries, and will in fact be the medium brigade itself plus one or two 18-pr. batteries.

The advantage of distributing medium batteries among the light brigades is, as far as infantry work is concerned, that infantry commanders, quite logically, do not wish to deal with more than one artillery commander, so that if that artillery commander has medium,

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as well as light pieces, things are easier. Also it may be argued that communication with engaged infantry may be quicker. There are not, for instance, in a medium brigade, enough officers to enable one to accompany each battalion of infantry; but in the whole divisional artillery there are enough. The light-battery liaison officers with the infantry thus afford the best channel by which the medium can get information. Now it may be argued that this channel is more likely to convey information valuable to medium guns, when it knows that its own Brigade Commander (or Group Commander) has some medium gun under him and will require information for them

I do not think there is very much in this argument. Often, in moving warfare these mixed groups will be organised on the spur of the moment; in trench warfare there may be more to be said for the idea. But in any case the medium brigade acting as a unit can, by good organisation, use these channels successfully. This we will discuss a little further on.

Now there is the question of the combined use of different natures of guns. For infantry work the 6″ How. can supplement the 4·5″ Howitzer on enemy strong points, etc., it can help in the protective barrage. Is the mixed group the best organisation for this? Possibly.

The 60-pr. can thicken an 18-pr. shrapnel barrage. Well, we have only one 60-pr. battery and we strongly deprecate its use in dispersed sections for the reason which we have given.

Both 18-prs. and 60-prs. combine most usefully with 6″ Hows. in counter-battery work. The 6″ How. shells the enemy's battery position and the 18-prs. or 60-prs. afterwards shrapnel his approaches and hinder the repair of damage and the replenishment of ammunition. In moving warfare the 18-pr. gets fine chances of effective C.B. work, especially in conjunction with the Air Force. Its rapidity of fire makes it an important auxiliary to the medium guns. But you cannot easily collect 18-prs. from different groups for this work.

Then, as to Advanced and Rear Guards. A medium battery, preferably a 60-pr. battery, is invaluable in the advanced guard. It helps to gain time for the main body by causing an attacking enemy to deploy sooner than that enemy would wish; it may get some rare opportunities of disorganising a retreating enemy.

Great freedom and latitude should be given to its battery commander. He may expect to be working continually with the Air Force. It is best that he should be directly under the O.C. Advanced Guard; but if that authority will not deal with him except through the commander of the light artillery of the advanced guard, then the latter must ensure that the medium battery commander has full latitude and is not diverted from his important tasks by less urgent demands.

Similarly medium artillery in the rear guard should be allowed freedom. In this case also it should get much from the air; much about the enemy's advancing artillery and his crowded roads. It is the light artillery which must do the actual pulling of the infantry out of successive positions by their protective fire.

The consideration of these various phases of artillery work may justly lead us to the conclusion that a wise Divisional C.R.A., in moving warfare will not lightly distribute all his medium batteries among the light brigades. To do that is not to divide and rule, but to divide and abdicate.

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He is more likely, in moving warfare, to retain in his own hands the power of dealing a heavy blow on a given objective at a given time, by working his medium brigade as a unit in the battle and by so placing its component parts on the march that their effect may be obtained quickly and freely, even as the wise sportsman keeps his rifle ready to his hand.

But he is quite likely, especially on a contracted front, to allot *some* medium guns to light brigades, retaining the majority in the medium brigade, and also to allot some 18-prs. to the medium brigade.

One might suggest, for instance, that a half battery (3 guns) of 6″ Hows. be allotted to one light brigade and a half battery to another. Then the medium, or C.B. brigade would have one 60-pr. battery and two 6″ How. batteries plus a battery (or two sections) of 18-prs.

As regards trench warfare, he will not have the medium brigade, as it will belong to Corps.

We are dealing with the present situation. If we were going to have divisional, as well as Corps medium brigades, there might be great advantages in the mixed group system for divisions.

The great hindrance to devising ideal combinations of guns, the rock on which all schemes split, is our organisation in two branches.

An experienced, able, skilful artillery commander of one branch receives units of another branch into his command. Is it not just possible that in spite of his ability and skill there may sometimes lurk in his mind an uneasy feeling of uncertainty, a growing doubt whether the expert whom he consults is really right, a half formed desire to try some doubtful experiment? Would he not sometimes give a good deal to have commanded one of these strange batteries for a year?

If so, will he not now in peace time consider how to give his young officers something of that which he has lacked?

Something *can* be done.

Recipe for co-operation in war between separate branches. (This dish is called "Suprême d'Artillerie").

First catch a light and a medium brigade at the same practice camp. Take a battery of one branch: add three subalterns of the other branch so that each shadows one of the battery subalterns, whether Gun Position Officer, Battery Leader, or Section Commander. Beat together thoroughly and season with explanation. Send out battery to shoot. Each subaltern of the other branch rides with one of the battery subalterns, watches his work carefully, watches the guns on the move and in action, watches the horses or tractors. After shooting from several positions, add 6 packets of sandwiches and 6 bottles of Bass. Allow the mixture to simmer down amid discussion and serve at conference.

In fact, first explain, then demonstrate, then execute.

There is more value in this sort of thing than in "combined days" or in attaching officers *in barracks* to other natures of batteries.

Our tactics and gunnery are similar. A certain amount, of watching of each other's practice from the O.P. end is good. But it is the knowledge of how guns move and shoot, of each other's facilities and difficulties which we require. We want to aim at using our guns according to the fire effect which we wish to produce, and it is simply lack of knowledge of what guns can do which causes us,

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when confronted with guns of other branches, to fall back on arbitrary rules, preconceived ideas and false analogies. The mere fact that a 60-pr. battery was, termed a heavy battery, while a 6″ Howitzer battery was termed a siege battery, and that their war establishments were composed on entirely different principles, is a clear proof of the solid ignorance as to the capacity and attributes of these weapons, which has led to so sloppy a terminology.

Now if a man gets a fair idea of what guns of other branches can do as regards mobility and work at the gun-position end, and then proceeds to study a little of their work from the O.P. end, he is in a better position to co-operate with them in war. And the channel along which the co-operation works to the best effect is from OP to OP.

I mean that the conditions of moving warfare, of savage warfare, of any warfare except elaborate trench warfare with masses of artillery, tend to throw the tactical control of guns more and more onto the man who can see. And the time has not yet come when the man who has to see will be always in the air.

The quickest route for ground information is from liaison officer with infantry to artillery OP. The OP then both sees and hears and, according to what he sees and hears, either (A) shoots, or (B) passes on information to his commander, or (C) passes on information to an OP of the other branch. Other branch OP, on that information, either (D) shoots or (E) passes on information to his commander.

This sounds elementary, but it is a fact that even in 1918 the route of information, (and information which required action) was often—Liaison officer with infantry—OP—Brigade Cdr.—Divisional Arty. HQ—Corps HA—HA Brigade—HA. OP!

Of course the proper authority must exercise control, but control is not taken away from him by information coming from OP to OP.

One reason for the circuitous route was undoubtedly the difficulty of getting OP's to liaise with those of other branches, even in cases where they were quite close together in the same trench. I have been told by O.O's, "But its no good, Sir, they don't understand us!" A perfectly true statement, but a very bad reason for not trying to get to an understanding. And so it gets burnt into you that we *must* understand each other.

Another reason was that there were so many brigades of different sorts of heavy artillery that a divisional artillery O.P. did not know to whom to convey the information. In this case, surely the quickest thing to do would have been to communicate with the nearest heavy O.P.

Of course I am aware that communication with the liaison officer with infantry did not always pass through the O.P., but it would seem to be a good system for moving warfare. Anyhow, it can be of great benefit to the medium brigade with a division on those occasions when they simply have not enough officers to liaise with all the infantry units.

There are many other channels of communication which are very valuable: from light brigade headquarters to medium brigade headquarters, from medium battery to the nearest light battery. The great problem for medium artillery is to get information quickly from the infantry. In our offensive of 1918 we could sometimes get it

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from our own liaison officers with infantry brigade headquarters but I believe I am right in saying that usually our best channel was through batteries or brigade headquarters of divisional artillery, who were ever ready to help, and who gave the most invaluable assistance. Looking, then, to the future, it is safe to assume that the one medium brigade working with a division, whether it maintain its integral organisation, or whether its batteries be detached, will constantly require to avail itself of the light artillery channels of information. One of the best channels will be—Liaison officer with infantry—Light Artillery OP—Medium Artillery OP.

And therefore it is of great inportance that our present organisations in two branches should not interfere with the establishment of mutual understanding and reciprocal knowledge.

This may well commence with the junior ranks of officers. We owe it to them that they should not lose that experience, the lack of which we know in our own minds has prejudiced the successful co-operation between guns and infantry in the past.

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NAVAL CHANGES IN RELATION TO COAST DEFENCE.

BY MAJOR T. W. SAIDLER, Forth R.G.A.

AT this time, when the whole question of Naval Armaments appears to be in the melting pot, it may not be uninteresting to make a rapid review of the subject so far as it affects us as Coast Defenders.

We are at present in the somewhat unusual position of not knowing whom we are going to be "up against" next! From almost the earliest historical times until within the last twenty years or so, France was regarded as our natural enemy, with the occasional addition of Spain and Holland, and in the sixties of last century we were erecting enormous piles of granite and iron such as Garrison Point, at Sheerness, Hurst Castle, on the Solent, The Spithead Forts, Coalhouse Fort on the Thames, Dover Pier Turret, and other similar works all round the South Coast for her benefit, and even in the eighties and nineties were keeping a watchful eye on the growing strength of her torpedo boat flotillas of the "jeune école."

Then came the German menace, and for the twenty years before the war there is no doubt that our scheme of defence was based mainly on the probability of an attack by the German Navy. That danger has come and gone. Many years must elapse before the German, if ever again, is able to challenge our power at sea. The French navy even if the *entente cordiale* did not exist, has dropped out of the race, the Italian is much in the same position and Bolshevism has destroyed the Russian Fleet, so that there is at the present moment no navy in Europe which could hope to enter the lists against our own, far less to make an attack upon our coasts. The centre of naval competition has for the time being, at any rate, shifted to the other side of the world and the United States and Japan have taken up the running.

While we have completed only *one* capital ship since the Armistice and have none building or even projected, we find that the United States has at this time no fewer than *eighteen* first class ships completing or projected, and Japan has *eight*. They were both our allies during the war, and Japan is bound to us by treaty which she has always implemented in the most loyal manner, and while we have no present reason to doubt the good faith of either, still with such a large proportion of Irish and German blood in the United States the elements of danger are never awanting, and the favourite game of "twisting the lion's tail" may sometime or other be carried just a little too far. In the same way our Australasian Colonies look with suspicion on Japan, and we have the United States casting the eye of doubt on our treaty with that country. So that until the long-heralded League of Nations has become more than a shadowy future, and—

> "The war drum throbs no longer, and the battle flag is furled
> In the parliament of man, the federation of the world"

it behoves us still to keep before us the question of national safety.

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During the six years and a half since the declaration of War in August 1914, the battleship has increased in power to an extent probably greater than at any similar period of its history, not even excepting the transition period from wood to iron. In August 1914, the "*Iron Duke*" was the latest completed battleship in the world. She displaced 25,000 tons and carried as her principal armament ten 13·5 inch guns. To-day the latest completed battleship in the British Navy is the "*Hood*" of 41,200 tons, a jump of 16,500 tons, something like 60% in six years! The "*Tennessee*" in the United States Navy, 32,300 tons with twelve 14-inch guns and much thicker armour than the "*Hood*" but less engine power and speed, is the latest ship of that country to run her trials, but the "*Maryland*" class of 32,600 tons and eight 16-inch guns (four ships) is already in the water as are the Japanese "*Nagato*" and "*Muttsu*" of similar size and power, while yet more powerful ships are projected in both these countries, the United States "*South Dakota*" Class being 43,200 tons with twelve 16-inch guns, and the "*Lexington*" class 43,500 tons. Both the United States and Japan, as our allies, had full access to the naval records of the war and it is rather egotistical of some critics of the big ship policy to write their designers down as fools. Neither the United States or Japan are countries likely to waste money on building such vessels just for fun!

It is at this time then, that has arisen once more the old cry "The Big Battleship is doomed", in fact that it is fit only to be relegated to the scrap heap.

Apart from questions of international policy and economy two reasons are given for this—

1. The increasing power of the submarine.
2. The increasing power of aircraft.

It is stated that from fear of submarines both the British and the German big ships were forced to remain in harbour, and that now even this refuge will be denied the big ships, as aeroplanes or seaplanes carrying bombs of enormous power, or automobile torpedoes, will raid these harbours and destroy the ships therein.

The opponents of the big ship, among whom Sir Percy Scott and Lord Rothermere are perhaps the most notable, declare that the only craft in the navy of the future are the submarine and the amphibious seaplane.

Now this outcry against the big ship is, as already mentioned, not a new one. We had in the seventies of last century the supporters of the Gun Boat, small craft of 200 to 400 tons carrying one heavy gun in the bow, of which the "Staunch" was the prototype, which were supposed to gather round the doomed Battleship, and, too small to be hit themselves, knock her to pieces with their heavy guns.

Then came the torpedo scare, when the torpedo boat was to be the only warship of the future. Later still the increase in power the long steel breech-loading gun gave rise to a theory that no armour could withstand it, and that therefore it was better to do away with armour which only caused the projectiles to burst, and trust entirely to very fast unarmoured vessels carrying a few of the new guns. The Elswick built Chilian cruiser "*Esmeralda*" was the exemplification of this view. The high explosive shell and improvements in armour,

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however, disposed of this theory, and we had also the "*Polyphemus*" a cigar shaped vessel supposed to be semi-submersible, but she was never repeated, and the Battleship emerged bigger and more powerful after each challenge to her existence. In Brassey's Naval Annual for this year, too, Sir George Thurston, the naval designer proposes as the "Capital Ship of the future", a vessel of 57,000 tons with eight 18-inch guns.

From the teaching of history and experience therefore we may gather that the big ship will always be the Mistress of the Seas, the *ultima ratio* of naval power. Altered in design the Big Ship may be, as she has been before, probably by doing away with much of the top hamper, and strengthening the decks to resist aerial attack, but even if entirely submersible she will still be of great size.

Already we have the submarines of the "M" class mounting a 12-inch gun, and we have only been a very short time on the way. Dr. Oscar Parkes, Editor of "Jane's Fighting Ships" the naval expert, shows us in the *Illustrated London News* of 15th January his idea of what is to supersede the Battleship—a Seaplane Carrier of some 30,000 tons and a submarine carrying four guns of at least 15-inches, judging by the drawing, just about as big as the much maligned battleship they are to displace!

The contention that the Battleships of the British Navy stayed in harbour for fear of the German submarines and aircraft is not founded on the least substratum of truth, as again and again the whole strength of the Grand Fleet including dozens of large Battleships and Cruisers left the Forth and scoured the North Sea from end to end without losing a single capital ship from these causes, and although the submarine and aircraft will gain in power in the future, so will the means of combating them. Nor was it the submarine or the aircraft that brought to book the Scarborough raiders, but our own battle cruisers, which by superior speed overtook them and by superior gun power sunk the "*Blucher*", and but for the unlucky hit which disabled the "*Lion*," would probably have disposed of the lot. Even Commander von Hase in his work "Die Zwei Weissen Volker" now appearing in English as "Kiel and Jutland" admits that it was our big ships that settled the question of the command of the sea in our favour, once and for all, and that the four ships of the "*Queen Elizabeth*" class stood the fire of nine German ships without suffering serious damage, a tribute to their design and construction.

The hydrophone, the depth charge and the submarine mine, as also the anti-aircraft gun are likewise capable of improvement. It certainly was one lesson on the war that as a general rule, submarine could not fight submarine, and that surface craft were thus absolutely necessary. To protect these, larger ships will be required, and to cover these again, still larger ones, so that we arrive at the big ship once more.

Aircraft however are an increasingly dangerous factor. Seaplanes carriers are becoming a feature in every navy, and the planes from them will thus appear in any attack on coast defences. True, a gun emplacement is a small target, and the chance of a hit from a bomb is still small, although taking into account the magazines, stores, shelters, etc. (which are generally fairly safe from fire from

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the sea), if the plane succeeds in getting overhead, probably greater then is the chance of a hit from gun fire from a ship. So, besides relying on our own fighting planes and our anti-aircraft guns to keep the enemy machines as far away as possible, some sort of overhead cover for our coast guns will become necessary, such as the latest gun mounting for the United States 16-inch gun, which has sloping armour plates on each side of the gun to protect the mounting and detachment.

The radius of action of the submarine has also largely increased. Even during the war the German submarines operated on the Coast of the United States, and the size and radius of action of these boats have increased greatly since then, and their power of submersion will give them great advantage over the surface craft in evading our patrols and cruisers in the open sea. In the event therefore of there ever being trouble between us and the United States there is nothing impossible in such craft operating on our shores, and even in the case of unpleasantness with Japan, doubtless her boats, accompanied by submarine storeships of the pattern of the famous "*Deutchland*" could appear in our waters. Distance will not give us the immunity from attack claimed for Coast Defences in the past, and those decriers of the big Battleship seem to forget this as they found a large part of their argument on the impossibility of large ships operating far from their base.

It would thus appear that whatever may be in store for our coast defences we are still going to be faced with attack by vessels of large size carrying heavy guns, and *the more we allow our navy to deteriorate in strength, the more probable it will become.* Even a two to one strength did not protect us against several raids by German cruisers and submarines, and we may guess what it would have been if the forces had been more equally matched.

These vessels may be submersible, but still to fire their guns they must come to the surface, so that our targets will still be large, and the well placed gun will still have the advantage, as nothing but a direct hit on the gun or shield will knock it out, while a hit anywhere on the 500 or 600 feet submersible, will, almost certainly, destroy its already small reserve of flotation and send it to the bottom, much more so than a similar hit on the side or deck of an ordinary surface craft. Whether, in view of the enormous increase in the size and power of ships, the guns generally mounted on our Coasts are sufficiently powerful, when other countries seem to consider it necessary to mount 13.5-inch, 14-inch and even 16-inch guns, is another matter.

Whatever may be the warship of the future, however, all that has transpired *now and* in the past, leaves us to face the fact, that if our navy is allowed to fall behind in the race, the country will immediately be confronted by the necessity of correspondingly increasing its Coast Defences. It was so in the time of the Spanish Armada, in the time of the Dutch war, in the days of Napoleon, as well as in the French Scare of 1859,and will be so in the future.

This paper is not put forward with any pretence of being comprehensive, but merely as a basis of discussion on the future of Coast Defence.

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ARTILLERY AND AIRCRAFT.

A plea for a closer co-operation in the future.

BY LIEUT. D. W. CLARKE, R.F.A. (LATE ATTCH. R.A.F.)

IN the days before 1914 idealists and theorists pictured wars of the future as one gigantic struggle of mighty aircraft. Artillery, they said, would be controlled entirely from the air, and all old ideas would then be revolutionised. An opportunity was soon forthcoming for them to put their theories into actual practise, and, from the very opening of hostilities, every effort was put forward to secure a complete cohesion between the guns and the 'planes : but, after four years hard fighting, although both ideas and material were rapidly improved, the co-operation at the time of the Armistice fell far short of the ideals so gaily vaunted when aviation was in its infancy.

The obstacles in the way of reaching this ideal were truly formidable, but they were all realised, and many of them overcome : so it remains for the Artillery and the Air Force of the future to surmount the remainder of these obstacles before the goal is reached.

Let us first diagnose these obstacles and then we shall be in a better position to decide how we can improve the present state of affairs.

The primary principle of this co-operation is that the artillery branches of the Air Force were created—and still exist— for the sole purpose of helping the Artillery. This fact has very often been missed by both the airmen and the gunners, and it lies to the gunners to make the best possible use of the airmen at their disposal. This can never be obtained without a very great sympathetic intercourse between the two; and consequently a fuller realisation of the difficulties confronting each Service. Co-operation in the sporting and social circles of Peace will result in a highly successful co-operation in the stress of War : and the acquisition of personal and individual co-operation will be the first step towards the final attainment of scientific artillery observation from the air.

The attachment of Gunner officers to the squadrons helped very much in the past, and, as it is to be maintained in the future, let us hope that it will lead both Services to a very close friendship. It would also be good to see, at some future date, flying officers living with the batteries to learn our methods and to realise our difficulties.

When once we have secured a close cohesion between the two Arms on a personal basis, we will then be able to turn to the more technical side of the question.

First let us decide on an ideal for which to strive, let us see how far we have fallen short of that ideal, and then let us make our plans for overcoming past difficulties.

In observation of artillery fire from the air, the highest ideal that we can reach is to bring the work of the observer in the aeroplane as

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near as possible to that of the observer in the O.P. In the past there has been a vast difference between these two. As regards the man himself: the ground observer on the one side was an officer of the Battery for which he observed, he was personally trained by the Battery Commander who knew exactly what he could expect of him. Furthermore, the observing officer knew his guns and his men, and he thoroughly understood how to direct their fire. The aerial observer, on the other side, had no knowledge whatever of gunnery, he was usually quite unknown to the Battery Commander, and he knew nothing of the peculiarities of the guns and the Battery in general.

This alone was a very unsatisfactory state of affairs, and consequently, the aerial observer could not do the same work as the man in the O.P.; whereas the battery officer could actually direct the fire of his battery, the airman could only tell the Battery Commander where his shots were falling, while he in turn would correct the guns.

Most gunners remember the results—difficulties in inter-communication, trouble with ground strips, and interpreting of long strings of code letters: all these caused delays and a consequent lack of efficiency.

If an observer in an O.P. were to climb up a tree he would not alter his system of observing, so why should he alter it when he goes up in an aeroplane? And here we have in a nutshell the key to our preblem—let the airman control the guns instead of merely locating the bursts. So let us see how near we can perfect this.

Our first difficulty is that of inter-communication, and here science shows us the way. Wireless Telephony is no longer a mere experiment, but is actually a working proposition; true it is still in its infancy, and a suitably portable apparatus has not yet appeared, but in a few years there is no reason whatever why telephonic communication with the observer in an aeroplane should not be as good as that with the F.O.O.—or perhaps better, for there are no wires to be cut!

In the actual observing there is one thing which an airman cannot do—he cannot correct the heights of shrapnel bursts in the air. However, this is not a great drawback, as it has been found that it is extremely difficult for a pilot to observe air bursts of shrapnel, and the occasions on which it will be necessary are too rare to worry us to any extent.

To give the line of fire to the guns presents no difficulties to the airman: he has merely to fly along the line Battery—Target, read the bearing of his line of flight from his compass, and give a magnetic bearing to the guns, who can get their line of fire from the director in the normal way.

As to correcting the bursts, the question of "plus" and "minus" is far easier from the air than it is from the ground; while corrections in range can easily be given in the same way, as an observer would previously have reported the error in range by his clock code. But he will now order "Add 200" instead of the "B.12" of the previous system.

Similarly he will order deflections. Any good observer can judge the distance right or left of the target in yards—as he did in the old clock code system—and the distance of the burst from the target in

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yards can be converted into deflection in degrees by a glance at a table pasted on the front of his dashboard.

Range is a little more complicated as it entails the use of two more instruments—a stop watch and a bombsight.

However, in most cases, the Battery Commander will be able to give the range previously by the map or other means.

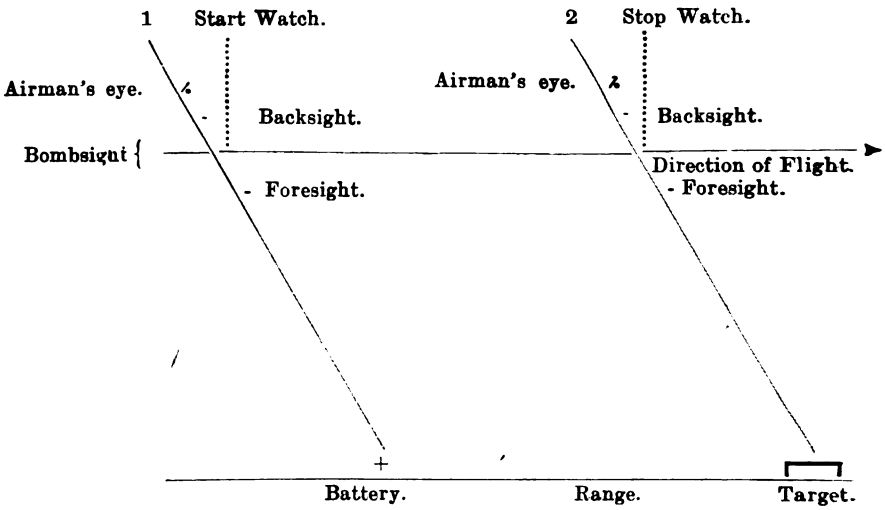

Diagram to illustrate method of calculating range from the air.

But a more or less rough range may be obtained by the following method. (See diagram.) The airman decides to fly at a pre-arranged height over the target. He obtains from the meteorological report the speed and direction of the wind at that altitude, and from that he can calculate his ground speed for any reading of his air speed indicator. He will then fly along the line Battery-Target, and, directly he sees the Battery position over his bombsight, he will release his stop watch until he sees the target over the sight, when he will stop the watch. He will then know his ground speed and his time of flight, which will give distance between the Battery and the Target—i.e. the Range— by a simple formula :—

$$\frac{\text{Ground speed in miles per hour}}{2} \times \text{Time of flight in seconds} = \text{Range (in yds.)}$$

Ground speed	=	100 m.p.h.
Time of flight	=	60 seconds.
$\frac{100}{2} \times 60$	=	Range in yds.
$\therefore$ 3000	=	Range in yds.

In this particular example the range when accurately worked out is 2933 yds. so the formula is only 67 yds. out. However, this system is only very rough—especially if there is a cross wind blowing—but it will suffice in an emergency to enable an observer to obtain his initial 300 yards bracket.

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Having obtained his brackets he can continue ranging, give deflections and switches, and conduct his shoot in the usual manner exactly as he would from an O.P.

But in order to obtain results from this method it will be necessary to alter the present system of organisation: and this brings us to a much discussed problem.

The scheme of re-organisation which I propose is roughly as follows. There is no reason why an efficient artillery biplane, on the lines of any high-powered Service machine— such as the Bristol Fighter—should not be fitted as a three-seater, to carry a pilot in front, an artillery observer, and an aerial gunner to man the rear Lewis guns. This system will dispense with the necessity of training the artillery officer as a pilot, and, in fact there is no reason why every artillery officer should not be able to observe the fire of his guns from the air.

This could soon be obtained by introducing courses of aerial observation for gunner officers, which, in itself, would help to secure a closer cohesion between the two services.

To return to the question of organisation. In the vicinity of each Artillery Brigade or Group there will be a landing ground (for each divisional area in trench warfare) at which there will be a flight of artillery machines (a squadron for the division). Here will be R.A.F. machines, pilots, aerial gunners and mechanics at the sole disposal of the Artillery Brigade Commander.

These machines will do no other work but to carry the observing officers of the Brigade, or to perform any other special duties which the Brigade Commander may desire. An R.A.F. officer will be attached to Brigade Headquarters to advise him in all aerial matters. As far as possible the same pilots will work with the same Batteries, so that they may get to know each other. Thus the pilots will know the various battery positions, and will be able to fly in the required direction without being constantly directed by the observer.

Let us now try and imagine the system, which I have outlined, in actual practice.

We find the Battery Commander of X Battery wanting to engage a certain target. He can find no suitable O.P. and therefore decides to engage it by aerial observation. He dispatches one of his subalterns to observe for him, and meanwhile he telephones to the landing ground to give his orders to the R.A.F. Unit, including the map location or description of the target and, if necessary, the Battery position. The pilot gets his machine ready for flight, spots the target on his map, and decides on his line of flight. The gunner arrives at the aerodrome on his horse and finds everything ready for him, he gets into flying kit and is soon off towards the Battery, testing his wireless telephone and "tuning in" en route.

If necessary he will obtain his line of fire and range by the methods previously explained, and then proceed to engage his target.

Only experience will show us how this system will work out in practice, and it may be necessary to modify it considerably; even to return to the old clock code system, but with the new co-operation and re-organisation.

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But, if the scheme which I have tried to portray in these pages should prove as successful in practice as it does in theory, then we shall have approached somewhere near to our ideal, and the observer in the air becomes as near as possible the same man as the observer on the ground, and, when this is obtained, then alone shall be have reached that standard of co-operation between artillery and aircraft for which we have ever been striving.

Inventions are constantly improving the equipments of both services, so that aerial observation may become more perfect each day, and the shooting of the artillery greatly improved in consequence.

Particulars as to the escorting of these artillery machines, and other technical questions, are matters for the internal administration of the Air Force; and, as we are only concerned now with the gunners' point of view, we can dispense with any further discussion.

However, we must still remember that this system can only be successful if a very close personal liaison and friendly feeling exists between the Regiment and the Air Force; and the acquisition of this liaison should be the aim of every Gunner and Airman.

Co-operation in the past has not been entirely successful, but it has taught us our lesson, and, if we will all strive for the same end, there is no reason why we should not obtain a really complete co-operation in the future—and without interfering with the individuality of either Arm: and thus we shall help very materially to improve the scientific shooting of Artillery.

Then perhaps our idealists of 1914 will feel more satisfied.

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NOTES ON FOREIGN JOURNALS.

America.

A translation of a lecture by Gen. le Gallais to the Officers of 16th Division on "Questions affecting Artillery" can be read in "The Field Artillery Journal" for May—June, July—Aug., Sept.—Oct., Nov.—Dec., 1920.

France.

Revue Militaire Générale.—Dec. 1920.

I. Foch's place in history. J.R.
From a book that has just been brought out by Payot. "Foch Essai de psychologie militaire"
This is a very interesting article. The writer commences by comparing—
(i) Foch with his contemporaries :—
Firstly—Foch and Petain.
Next—Foch and Joffre.
Finally—Foch and Ludendorff.
(ii) Foch and the Chiefs of the 19th Century.

II. Transportation by Rail of the American Army in France (1917-1919) continued. Lt.-Col. Andriot.

III. The rôle and tactics of the Corps Heavy Artillery. Comdt. Perney.

IV. Basis of reorganisation of the Native Army in N. Africa.

Revue d'Artillerie.

I. Recuperator Buffers. L. Graux.

II. Impressions of a gunner in the occupied territory. H. Brun.

III. The two French Schools of Internal Ballistics.
F. Desmazières.

IV. Recruitment and employment of military and civil labour. Lt.-Col. Delavallé.

V. *Foreign News*—

Motor traction on narrow gauge railway track. (Method used in S. Africa of mounting the fore part of a road tractor on a bogie truck, while the hind wheels remain on the ground outside the railway track).

War losses—(a comparative table of losses of belligerent nations).

Germany—Official armament of the Reichswehr.

England—Attention drawn to "Proceeedings of Royal Society" May 1920—article on distribution of pressure on the surface of projectiles.

Austria—Hungary—Use of seismatograph for locating enemy batteries.

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Belgium.

Bulletin belge de Sciences Militaries.—Feb. 1921.

I. Operations of the Belgian Army, 1914-1918 (continued).

II. Gas Warfare. Dr. Sillevaerts.

III. Belgian Strategic Railways during the war 1914-1918 (continued). Maj. A. E. M. Denis.

IV. The officers rôle in war (continued). Capt. Ct. Menzel.

V. The single wheel stretcher. Dr. de Block.

VI. Aviation. Security of the aeroplane at reduced speeds.

VII. Notes on Foreign Armies.

A. *Germany.* (1) The Army of 100,000 men may be considered as constituted.

(2) Projected new Military Laws—nearly conforms to the conditions of the Treaty of Versailles except that the abolition of obligatory military service in the States is not formally adopted.

Certain unauthorised units exist such as cavalry bridging train, cyclist companies, pioneer companies possessing railway *matériel* (which is forbidden).

(3) A regiment called "Wach Regiment Berlin" to be quartered at Döberitz—3 infantry battalions, 1 company of mine throwers, 1 field battery, 1 squadron.

Mission—Special protection of the capital.

It is difficult to see why it is wanted as Berlin has 17,000 State Police (formerly security Police). Perhaps it is really a school of instruction for the new army. The fact that the regiment is quartered in the Guards Camp at Döberitz makes this seem likely.

(4) Disarmament of the Citizen Guards. (Orgesch). Still standing fast. Germany evidently trying to gain time and obtain concessions.

(5) Deliveries and destruction of material. 11 Dec. 1920.

Guns	36,000	33.600	destroyed.
Minethrowers	10.510	7,600	,,
Machine guns	65,400	50,300	,,
,, tubes	97,600	52,500	,,
Small arms	2,785.000	2,305.000	,,
Flame projectors	950	650	,,

(6) Disarmament of the Population.

Up to Dec. 1920 the Commission of Control had only received 540 guns, 570 minethrowers, 5,200 machine guns, 432.000 small-arms.

(7) Four 28^{cm} guns on Railway mountings that the Germans had dragged into Holland were delivered in Belgium in December last.

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Amongst books reviewed is :

"How the world-war started" by Kautsky (German) translated into French. (Berlin. Cassirer. 1919). The object of the book to prove that the German Government who made the war is quite different from that who made the peace, and the innocence of the German People. "The present Government is innocent, the German people are innocent, the victorious Allies cannot punish innocent people!"

Switzerland.

Revue Militaire Suisse. Jan. 1921.

I. The IXth French Corps in the battle of the Marshes of St. Gond (with Map). Col. H. Poudret.

II. The instruction of an infantry unit. Col. A. Fonjallez.

III. Military Ski-ing. Capt. W. Decollogny.

IV. The Franco-Serbian Artillery at the battle of the Dobropolie.

V. Swiss, French and Belgian Notes.

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"DUNCAN" GOLD MEDAL COMPETITION, SUBJECT FOR 1920-21.

The Subject approved for the "Duncan" Gold Medal Prize Essay 1920-21, is as follows:—

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for horse draught, both on the road and across country."

The Rules for the Essays now read:—

The Annual Gold Medal, when awarded, to be accompanied by an *honorarium* of £20; the Silver Medal by an *honorarium* of £10.

The subject will be a Field (including Horse) Artillery subject one year and a Garrison (including Mountain) Artillery one the next year.

The candidates must be Officers of the Regiment who are members of the R.A. Institution.

Officers of the R.H.A. and R.F.A. will be allowed to compete for the Garrison Artillery subject, and Officers of the R.G.A. for the Field Artillery subject.

Officers are requested to confine their Essays to about 16 printed pages of "The Journal of the Royal Artillery," other things being equal, brevity will count towards success.

The Essays must be forwarded to the Secretary so as to reach him on or before the 1st of April, 1921, they should be marked "Duncan Essay" on the outside of the cover which should be sealed.

Each Essay must be type-written in triplicate. The Essays must be strictly anonymous, but each to have a motto, and be accompanied by a sealed envelope with the motto written outside and the name of the writer inside. Only one of these sealed envelopes is required for each set of Essays not three.

Further, if the writer wishes to recover from the Committee part of the cost of typewriting his Essay he should state this fact in the same sealed envelope, and write outside it, above the motto, "To be opened." All the envelopes thus marked will be opened by the Secretary after the result of the competition has been announced, and he will send the writers the money for their type-writing expenses. The Committee will allow a sum of £1 for type-writing each Essay.

The prize Essays and those commended become absolutely the property of the R.A.I. and cannot be published by the author without the sanction of the Committee. The remaining Essays, if applied for, will be returned, and can be used by their authors.

The Essays will be submitted for decision to three Judges chosen by the Committee.

The Judges are empowered to recommend:—

1.—That two Medals, one Gold and one Silver, be awarded, or

2.—That only one Medal, Gold or Silver, according to the merit of the Essay, be awarded, or,

3.—That no Medal be awarded.

The names of the successful candidates will be announced at the Annual Meeting, and Medalists will be distinguished as such in all Lists, &c., issued from the Institution, and in the event of a University man gaining a Medal, a report of his success will be made to the University of which he may be a member.

The Gold and Silver Medal Essays will be printed and circulated to members by the Institution.

If there are any Essays which do not gain a Medal but are commended by the Judges, it will be at the discretion of the Committee to publish them or not as they think fit.

N.B.—The Committee draw particular attention to the paragraph in the Rules above on the subject of length of Essays; a page of the "Journal" is roughly 550 words.

SUBJECT FOR 1921-22.

Officers who have any suggestion as to a suitable subject for the "Duncan" Medal Essay competition for 1921-22, should send the same to the Secretary, R.A. Institution, before the 1st April, 1921.

The subject for the year in question should refer to Garrison Artillery.

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HONOURS.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign:—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

Decorations conferred by His Majesty The King of The Belgians.

ORDRE DE LEOPOLD.

OFFICIER.

Atkinson, Hon. Brig.-Genl. B., C.B., C.M.G., Reserve of Officers.
Fraser, Col. L. D., C.B., C.M.G.
McHardy, Col. (temp. Col. on the Staff) A. A., C.B., C.M.G., D.S.O.
Wilson, Col. L. M., C.M.G., D.S.O.

CHEVALIER.

Browell, Hon. Brig. General W. B., C.M.G., Reserve of Officers
Fitzmaurice, Hon. Brig.-General R., C.B.E., D.S.O., Reserve of Officers.

CROIX DE GUERRE.

Alford, Major A. C. R., R.G.A.
Bartholomew, Col. (temp. Colonel on the Staff) W. H., C.B., C.M.G., D.S.O.
de'Brett, Col. H. S., C.B., C.M.G., D.S.O.
King, Captain J. E., M.B.E., R.G.A. (Reserve of Officers).
Pellew, Major V. H. L., M.C., R.G.A.
Radcliffe, Major-General Sir P. P. de B., K.C.M.G., C.B., D.S.O.
Rose, Major D. D., M.C., Royal Artillery.
Stansfeld, Captain L. R., R.G.A.
Thwaites, Major-General Sir W., K.C.M.G., C.B.

REGIMENTAL LIST. The following Postings have occurred during the period 15th January, to 13th February, 1921.

Postings.—R.H. and R.F.A.

RANK & NAME.		FROM.	TO
		3/1/21.	
Major	McLeod, N. M., D.S.O., M.C.	G.S.O., India.	Bde. Maj., R.A., India.
		14/1/21.	
Lieut.	Cave, S. H.	Employed Signals.	W.A.F.F.
„	Elliott, L. A. L.	do.	do.
		17/1/21.	
Lieut.	Stewart, W. F. (D.O.)	III Res. Bde., R.F.A.	India, on appt. to D.O.
Capt.	Earle, E. G., D.S.O.	India.	Officer of Coy. Gent. Cadets, R.M.A. Class "A."
Major & Bt.Lt-Col	Haining, R. H., D.S.O.	Staff College Course.	G.S.O. 2, M.O. 1, W.O.
		18/1/21.	
Capt.	Fulcher, G .E. T., (D.O.)	6 Depot, R.F.A.	No. 4 Amm. Col., Ind.
		19/1/21.	
Lieut.	Bingham, H. F.	Attd. E/5 Bde. R.H.A.	83/11 Bde., R.F.A.
Major & Bt.Lt-Col	Broad, C. N. F., D.S.O.	G.S.O. 1, Staff Coll.	20/9 „
Capt.	Bather, E. J., D.S.O.	Provost Duty, Rhine.	3/37 „
„	Russell, C. C., M.C.	3/37 Bde., R.F.A.	Probationary Exptl. Officer. Exptl. Est.
Lieut.	Williams, H. C.	S. Capt. Mesopotamia.	83/11 Bde., R.F.A.

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Postings R.H. & R.F.A.—*Continued.*

RANK & NAME.		FROM.	TO
		20/1/21.	
Major	Addison, A. M.	19/9 Bde., R.F.A.	16th Bde., R.F.A.
Capt.	D'Arcy, J. C., M.C.	Garr. Adjt., Ludd.	R.F.A., India.
Lieut.	McBarnet, A. A. E.	32nd Bde., R.F.A.	18th Bde., R.F.A.
,,	O'Reilly, T., M.C.	Sig. Training Centre.	78/11 Bde., R.F.A.
Major & Bt.Lt-Cl	Sykes, F. B., D.S.O.	II Depot, R.F.A.	18/3 Bde., R.F.A.
Lieut.	Wright, W. B.	21st Bde., R.F.A.	20th Bde., R.F.A.
,,	Ward, D. F.	18th Bde., R.F.A.	59/18 Bde., R.F.A.
		21/1/21.	
Capt.	De Burgh, H. G., M.C.	29/31 Bde., R.F.A.	85/11 ,,
Lieut.	Smith, J. Melville.	10th Bde., R.F.A.	36/33 ,,
		22/1/21.	
Major	Pinney, G. A., M.C.	Adjt., 28 Bde., R.F.A.	Adjt., R.M.A.
		27/1/21.	
Lieut.	Bingham, R. H., M.C.	14/4 Bde., R.F.A.	II Res. Bde., R.F.A.
,,	Murison, C. A. P., M.C.	9th Bde., R.F.A.	Attd. R.E. Mounted Depot.
Capt.	Marson, A. A., M.C.	3rd D.A.C.	101/21 Bde., R.F.A.
Lieut.	Price, A. E.	12th Bde., R.F.A.	I Res. Bde., R.F.A.
		28/1/21.	
Lt.-Col.	Ballingall, H. M., D.S.O.	India.	Cmd. 21st Bde. R.F.A.
,,	Cossart, A. R. B., D.S.O.	,,	,, 25th ,,
,,	Cornes, H., D.S.O.	,,	,, 20th ,,
,,	Clark, C. H., D.S.O.	,,	,, 24th ,,
,,	Crofton, M., D.S.O.	66/4 Bde., R.F.A.	,, 23rd ,,
Lieut.	Miers, P. R. P.	61/14 Bde., R.F.A.	V Res. Bde., R.F.A.
		29/1/21.	
Lieut.	Cutbush, H., M.C.	India.	64/5 Bde., R.F.A.
,,	Godfrey, J. M.	Attd. R.A.F.	98/1 Bde., R.F.A.
Major	Savile, L. W., D.S.O.	14/4 Bde., R.F.A.	2nd D.A.C., India.
		31/1/21.	
Major	Stillwell, W. D., D.S.O.	147/3 Bde., R.F.A.	Attd. IV Res. Bde., R.F.A.
		1/2/1921.	
Major	Cooper, C. G. A.	68/14 Bde., R.F.A.	12th (Suffolk) A.F.A. Bde., R.F.A., T.F.
		2/2/1921.	
Lieut.	Varcoe, T. W.	33/33 Bde., R.F.A.	36/33 Bde., R.F.A.
,,	Watkins, J. H.	32/33 Bde., R.F.A.	36/33 Bde., R.F.A.
		3/2/1921.	
Capt.	Batten, J. F., M.C.	R.F.A., India.	69/6 Bde., R.F.A.
		5/2/1921.	
Lieut.	Alban, A. H. A., D.F.C.	Attd. 16th Bde., R.F.A.	89/16 Bde., R.F.A.
,,	Crofton, R. C. M., M.C.	Riding Establishment.	139/8 Bde., R.F.A.
,,	Mason, H. B.	Attd. 16th Bde., R.F.A.	140/16 Bde., R.F.A.
Major	Taylor, V. A. H.	Attd. 2nd Bde., R.F.A.	Attd. 5th Bde., R.F.A.
		8/2/1921.	
Lieut.	Bolton, L.	28th Bde., R.F.A.	144/15 Bde., R.F.A.
,,	Critchley, G. H., M.C.	do.	12/35 Bde., R.F.A.
Capt.	Chads, W. J., M.C.	do.	136/1 Bde., R.F.A.
Lieut.	Darling, E., M.C.	do.	60/7 Bde., R.F.A.
,,	Darley, R., M.C.	do.	22/34 Bde., R.F.A.
Major	Eliott, R. H., D.S.O.	do.	87/2 Bde., R.F.A.
Capt.	Empson, A., M.C.	do.	31/35 Bde., R.F.A.
Lieut.	Learmont, D. A.	do.	79/6 Bde., R.F.A.
Capt.	Milton, F. R. G., M.C.	do.	143/15 Bde., R.F.A.
Lieut.	Montgomery, G. W. C.	do.	IV. Res. Bde., R.F.A.
Lt.-Col.	Queripel, L. H., C.M.G., D.S.O.	do.	VI. Res. Bde., R.F.A.
Lieut.	Scroggie, J. R. O'D.	do.	65/3 Bde., R.F.A.
,,	Weigall, E. T.	do.	20/9 Bde., R.F.A.

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Postings R.H. &. R.F.A.—*Continued.*

RANK & NAME.		FROM	TO
		9/2/1921.	
Major	Conner, D. G., O.B.E.	2nd Bde., R.F.A.	65 3 Bde., R.F.A.
		10/2/1921.	
Capt.	Browne, H. S., D.S.O., M.C.	Staff Capt. R.A. Egypt.	3 D.A.C., India.
		11/2/1921.	
Lieut.	Killeen, C. B.	97/19 Bde., R.F.A.	III. Res. Bde., R.F.A.
		12/2/1921.	
Major	Harford, H. H.	122/28 Bde., R.F.A.	R.F.A., India.

Cancellation of Postings.

Lieut. Baldwin, C. L. Posting dated 31/12/20 to V Res. Bde. is cancelled.
Capt. Danby, W. A. Posting dated 4/12/20 to 3rd D.A.C., India, is cancelled.
Capt. D'Arcy, J. C. Posting dated 20/1/21 to R.F.A. India is cancelled.
Capt. Hodges, A. P., M.C. Posting dated 8/12/20 to 2 D.A.C. India, is cancelled.

The units of the undermentioned Officers are as now stated:—

Lieut.	Ashe, V. C.	—	18th Bde., R.F.A.
Capt.	Barkworth, H. E.	—	1st D.A.C., India.
,,	English, M. W.	—	18th Bde., R.F.A.
Lieut.	Harvey, H. B.	—	32nd Bde., R.F.A.
Col.	Lamont, J. W. F., C.B., C.M.G., D.S.O.	—	C.R.A. Northumbrian Division T.F., from 1/2/21.
,,	Kirby, A. D., C.B., C.M.G.	—	C.R.A. Estn. Cd., Ind. from 1/4/21. To be Temp. Col. Comdt.
,,	Smith, L. A., D.S.O.	—	C.R.A. 53 Welsh Div. T.F., from 1/4/21.
Lieut.	Mackay, W. G., M.C.	Infantry, Ireland.	Somaliland Camel Corps, 28/1/21.
Lieut.	Larder, D. A.	—	26th Bde., R.F.A.

Staff Appointments.

		14/11/1920.	
,,	Green, A. P.	2nd Bde., R.F.A.	D.A.P.M., 6th Divl. Area.
		4/2/1921.	
Capt.	Straker, H. G.	A.D.C. to Genl. Bingham.	Attd. Officer. H.Q., Armts. Sub Commn., I.A.C., Berlin.
Lieut.	Robertson, H. N., M.C.	R.E., Rhine.	A.-D.-C. to Genl. Bingham, I. A. C., Berlin.
,,	Blake, F. A. A.	I.A.C., Germany.	Attd. Officer in M.I. 3 b., War Office.
,,	Lucas, R. H. A.	16th Bde., R.F.A.	Reconn. Officer, 3rd Divn., Egypt.
,,	Reveley, G. M.	16th Bde., R.F.A.	Camp Comdt., H.Q., 3rd Divn., Egypt.
		8/2/1921.	
,,	Gairdner, C. H.	Intell. Officer, V. Divn.	Intell. Officer. Class GG. Galway Bde.
		13/2/1921.	
Lt.-Gen.	Birch, Sir J. F. N., K.C.M.G., C.B.	—	Director General of Territorial & Vol. Forces, War Office.

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Postings.—Royal Garrison Artillery.

RANK & NAME.		FROM.	TO
		21/11/1920.	
Capt. & Bt. Maj.	Mills, H. P. F.	H.Q., Ireland.	Garr. Adjt., Dublin, Class FF. (Temp).
		3/1/21.	
Lt.-Col.	Rowan-Robinson, H., C.M.G., D.S.O.	H.Q. & D.E., Tees & Tyne.	Asst. to M.G., R.A., A.H.Q., India.
		15/1/21.	
Lieut.	Fitzgerald, E.	Sierra Leone.	10th Bde., R.G.A.
Capt.	Lang, N. C.	39/10 Bde., R.G.A.	Adjt., 9th West Ridg. & Staffs. Brigade, R.G.A., T.F.
		17/1/21.	
Lieut.	Hyde, H. T. (D.O.)	Sierra Leone.	11 Fire Command.
		18/1/21.	
Lieut.	Goldstein, B. A.	"G" Coast Battery.	4 Fire Command.
,,	Lewis, F. W.	4 Fire Command.	"G" Coast Battery.
		19/1/21.	
Lt.-Col.	Corrie, G. G. W.	India.	2 Brit. Pack Bde., R.G.A.
		20/1/21.	
Lieut.	Jensen, G. H.	Gibraltar.	"C" Coast Battery.
Capt.	Montague, J. E. F.	India.	10th Bde., R.G.A.
Lieut.	Picon, F.	10th Bde., R.G.A.	School of Artillery.
Major	Stanbrough, L. K., D.S.O.	11 Fire Command.	India.
		21/1/21.	
Lieut.	Foulger, F.	D.G.R.E., France.	I Res. Bde., R.G.A.
Major	King, A. E.	I.A.C., Berlin.	11 Fire Command.
		22/1/21.	
Lieut.	Height, W. A.	France.	"B" Coast Battery.
,,	Cope, H.,	D.G.R.E., France.	"E" Coast Battery.
,,	Crouch, C. H.	,,	10th Bde., R.G.A.
,,	Shapland, J. D., M.C.	Black Sea.	40/10 Bde., R.G.A.
		24/1/21.	
Lieut.	Boston, G.	D.G.R.E., France.	D.G.R.E. Scottish Cd.
,,	Suddick, R. H.	,,	D.G.R.E. Southern Cd.
,,	Wallace, B. E.	,,	D.G.R.E. Eastern Cd.
Lieut.	Saalfeld, A. E.	"A" Coast Battery.	Asst. Camp. Comdt., Class G.G., Rhine.
		25/1/21.	
Capt.	Gurney, L.	Attd. 1st Pack Bde., R.G.A.	29th Battery, R.G.A.
,,	Stebbing, H. T.	India.	H.Q., Ireland.
		26/1/21.	
Major	Barne, W. B. G., C.B.E., D.S.O.	A/G.S.O. 3, T.F.	14/4 Bde., R.G.A.
Lieut.	Fitzgerald, E., M.C.	10th Bde., R.G.A.	29th Bty., R.G.A.
		29/1/21.	
Lieut.	Maw, W.	A.A. Depot.	"H" Coast Battery.
		3/2/1921.	
Lieut.	Venables, W., D.C.M.	Signal Training Centre.	4/1 Bde., R.G.A.
		5/2/1921.	
Capt.	De Fonblanque, E. B.	9th Bde., R.G.A.	Ridg. Estab., R.H.A.
Lieut.	Thomas, J. G.	T. & Medway Defences.	4th Bde., R.G.A.
		12/2/1921.	
Capt.	Brown, L. N. F., D.S.O.	Sierra Leone.	R.G.A., Gibraltar.

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R.G.A. Postings—*Continued.*

Cancellation of Postings.

Capt. Barry, R. J. Posting dated 23/12/20 to H.Q., Ireland, is cancelled.
Capt. Brown, L. N. F. Posting dated 30/11/20 to Soudan Det., is cancelled.
Lieut. Lejeune, F. D. St. B. Posting dated 29/10/20 to 29/10 Bde., R.G.A., is cancelled.

Staff Appointments.

8/2/1921.

Capt.	Parker, G. L.	II. Res. Bde., R.G.A.	Courts Martial Offr., Northn. Comd. (not class FF).

REGIMENTAL LIST. The following Casualties have taken place from 16th January, to 15th February, 1921.

Promotions.

Bannerman, 2nd Lieut. J. P., to be Lieut., 23rd Jan., 1921.
Barni, 2nd Lieut. C. A., to be Lieut., 23rd Jan., 1921.
Battye, 2nd Lieut. J. C. A., to be Lieut., 23rd Jan., 1921.
Bettridge, 2nd Lieut. R. F., to be Lieut., 23rd Jan., 1921,
Blount, Major & Bt. Lt.-Col. G. P. C., D.S.O., to be Lt.-Col., 1st Jan., 1921.
Boyle, 2nd Lieut. C. L., to be Lieut., 23rd Jan., 1921.
Carr, 2nd Lieut. R. M., to be Lieut., 23rd Jan., 1921.
Carter, 2nd Lieut. I. P., to be Lieut., 23rd Jan., 1921.
Clarke, 2nd Lieut. W. S., to be Lieut., 23rd Jan., 1921.
Cottier, 2nd Lieut. H. H., to be Lieut., 23rd Jan., 1921.
Dobbs, 2nd Lieut. N. C., to be Lieut., 23rd Jan., 1921.
Dods, 2nd Lieut. I. W. E., to be Lieut., 23rd Jan., 1921.
Dunbar, 2nd Lieut. G. R., to be Lieut., 23rd Jan., 1921.
Finch, Major G. F. C., to be Lt.-Col., 1st Jan., 1921.
Grose, Major J., to be Lt.-Col., 1st Jan., 1921.
Gubbins, 2nd Lieut. M. E., to be Lieut., 23rd Jan., 1921.
Guille, 2nd Lieut. J. D. de C., to be Lieut., 23rd Jan., 1921.
Hardy, 2nd Lieut. G. T., to be Lieut., 23rd Jan., 1921.
Jacob, Major A. L. B., to be Lt.-Col., 1st Jan., 1921.
Kemble, Major W. E., to be Lt.-Col., 1st Jan., 1921.
Laurie, Major & Bt. Lt.-Col. to be Lt.-Col., 6th Jan., 1921.
Lever, 2nd Lieut. E. A., to be Lieut., 23rd Jan., 1921.
Linehan, 2nd Lieut. J. D. G., to be Lieut., 23rd Jan., 1921.
Lloyd, Major O. S., to be Lt.-Col., 3rd Jan., 1921.
Miller, 2nd Lieut. K. C., to be Lieut. 23rd Jan., 1921.
Morgan, 2nd Lieut. W. A. C. H., to be Lieut., 23rd Jan., 1921.
Murray, Major & Bt. Lt.-Col. F. M., to be Lt.-Col., 1st Jan., 1921.
Normand, Major S. R., D.S.O., to be Lt.-Col., 4th Feb., 1921.
Oswell, 2nd Lieut. E. H., to be Lieut., 23rd Jan., 1921.
Pearson, 2nd Lieut. S. R., to be Lieut., 23rd Jan., 1921.
Queripel, Maj. & Bt. Lt.-Col. L. H., C.M.G., D.S.O., to be Lt.-Col., 17th Jan., 1921.
Richards, 2nd Lieut. C. W. B., to be Lieut., 23rd Jan., 1921.
Rybot, 2nd Lieut. F. J. C., to be Lieut., 23rd Jan., 1921.
Saunders-Jacobs, 2nd Lieut. A. B., to be Lieut., 23rd Jan., 1921.
Smith, 2nd Lieut. E. B., to be Lieut., 23rd Jan., 1921.
Southern, 2nd Lieut. P. W., to be Lieut., 23rd Jan., 1921.
Strong, 2nd Lieut. E. I. E., to be Lieut., 23rd Jan., 1921.
Thursfield, 2nd Lieut. R. M. C., to be Lieut., 23rd Jan., 1921.
Tompkins, Lieut. (D.O.) J. W., M.C., to be Capt., 16th Dec., 1920, and Bt. Major, 16th Dec., 1920.
Vander Kiste, Major F. W., D.S.O., to be Lt.-Col., 6th Jan., 1921.
Wright, 2nd Lieut. R. F., to be Lieut., 23rd Jan., 1921.

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To Half Pay.

Allcard, Lt.-Col. H., D.S.O., 1st Jan., 1921.
Batchelor, Major V. A., D.S.O., 20th Dec., 1920.
Clarke, Lieut. A. V., 12th Feb., 1921.
Hyde-Johnson, Lieut. A, 1st Oct., 1920.
Jowett, Lieut. V. H., 9th Jan., 1921.
Kinsman, Lt.-Col. G. R. V., C.M.G., D.S.O., 17th Jan., 1921.
Lawton, Lieut. P. N. A. C., 28th Jan., 1921.
Lewis, Lt.-Col. P. K., C.M.G., D.S.O., 4th Feb., 1921.
McLellan, Lieut. W., 22nd Jan., 1921.
Mitchell, Lieut. F. A., 10th Feb., 1921.
Pring, Lieut. N. G., 1st Oct., 1920.
Robinson, Lieut. W. D., 22nd Jan., 1921.

Retirements on Retired Pay.

Barry, Lieut. W. J., 8th Feb., 1921.
Boyce, Lieut. F. D., 1st Feb., 1921.
Candler, Lieut. E. E., 26th Jan., 1921.
Carley, Lieut. J. W., 19th Jan., 1921, with rank of Capt.
Carnochan, Lieut. D. S., 26th Jan., 1921.
Chaworth-Masters, Capt. A., 29th Jan., 1921.
Clarke, Capt. R. G., 29th Jan., 1921.
Colquhoun, Lieut. R. G., 3rd Feb., 1921, with rank of Capt.
Cook, Lieut. F. W. E., 29th Jan., 1921, with rank of Major.
Donovan, Lieut. James, 26th Jan., 1921.
Dorman, Capt. C. H., 28th Jan., 1921.
Duncan, Lieut. C., 15th Feb., 1921.
Edgar, Lieut. P., 8th Feb., 1921.
Edmundson, Lieut. G. R., 21st Jan. 1921, with rank of Capt.
Edwards, Lieut. E. A., 3rd Feb., 1921.
Ellison, Major (D.O.) W. R., M.B.E., 6th Dec., 1920.
Farnden, Lieut. J. G., 3rd Feb., 1921.
Faux, Lieut. C. E., 29th Jan., 1921.
Fraser, Major A. H., 12th Feb., 1921.
Freer, Capt. R. C., M.C., 19th Jan., 1921, with rank of Major.
Garritt, Lieut. B., 26th Jan., 1921, with rank of Capt.
Green, Lieut. P. J., 10th Feb., 1921, with rank of Capt.
Griffith, Major G. M., 5th Feb., 1921, with rank of Colonel.
Hall, Lieut. C. E., 25th Jan., 1921.
Higgens, Lieut. W. S., M.C., 20th Jan., 1921, with rank of Capt.
Horne, Capt. H. G., 15th Feb., 1921.
Ivens, Major C. W. M., 5th Feb., 1921.
James, Lieut. A., 26th Jan., 1921.
Johnson, Lieut. J., 10th Feb., 1921, with rank of Capt.
Keast, Lieut. G. H., 15th Feb., 1921, with rank of Capt.
Kerans, Major H. J. D., 22nd Jan., 1921.
Leech, Major C. J. F., M.C., 15th Jan., 1921.
Leete, Lieut. R. J., 19th Jan., 1921.
Lewis, Major & Bt. Lt.-Col. W. H., D.S.O., M.C., 26th Jan., 1921.
Lillis, Lieut. P. J., 19th Jan., 1921, with rank of Capt.
Linehan, Lieut. G. E., 15th Feb., 1921, with rank of Capt.
Mackintosh, Col. J. B., D.S.O., 14th Feb., 1921.
Maule, Lt.-Col. H. N. St.J., C.M.G., 20th Jan., 1921.
Miles, Major E., 1st Feb., 1921.
Naylor, Rid.-Mr. & Lt.-Col. H. W., 6th Jan., 1921.
Parker, Lieut. A. H., 15th Feb., 1921.
Poor, Lieut. W. A. J., 15th Feb., 1921.
Ramsey, Lieut. T. V., 1st Feb., 1921.
Riches, Lieut. G. H., 1st Feb., 1921.
Rundle, Lieut. S. W., 25th Jan., 1921.
Savory, Lieut. W., M.C., 5th Feb., 1921, with rank of Capt.
Scott, Maj.-Genl. Sir. A. B., K.C.B., D.S.O., 1st Nov., 1920.
Stewart, Lieut. A. B., 19th Jan., 1921, with rank of Capt.
Thackwell, Major N. E. O., O.B.E., 12th Feb., 1921.
Turner, Capt. J., 21st Jan., 1921.
Wheatley, Lieut. W. A., 15th Feb., 1921.
Wheaton, Lieut. J. C., 15th Feb., 1921, with rank of Capt.
Wheeler, Lieut. H. J., 20th Jan., 1921.

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Retirements with a Gratuity.

Gilbert, Lieut. H., 10th Feb., 1921.
Graham, Lieut. R. O. H., 1st Feb., 1921.
Harrison, Lieut. N., 26th Jan., 1921.
Humphris, Lieut. T. H., 8th Feb., 1921.
Lambert, Lieut. V. G., 10th Feb., 1921.
Le Breton, Capt. F. H., M.C., 21st Jan., 1921, with rank of Major.
Lowe, Lieut. A. H., 22nd Jan. 1921, with rank of Major.
Moore, Lieut. J., M.M., 15th Feb., 1921.
Mozley, Lieut. J. W., M.C., 19th Jan., 1921.
Oakes, Lieut. G. H., 31st Jan., 1921.
Raintord, Lieut. W., 1st Feb., 1921.
Wakeling, Lieut. A., 1st Feb., 1921.

Resignations.

Champneys, Lieut. E. G. S., M.C., 20th Jan., 1921.
Keeling, Lieut. G., 17th Jan., 1921.
Powell, Lieut. J. B., 8th Feb., 1921, with rank of Capt.
Sawer, Lieut. D. W. R., 26th Jan., 1921.
Tuck, Lieut. W. D., 18th Jan., 1921.
Williams, Capt. W. S., 22nd Jan., 1921.

Transfers.

Evans, Lieut. L. P., to Army Educational Corps, 24th Dec., 1920.
Gill, Capt. N. J., C.B.E., M.C., to Royal Air Force, 1st Aug., 1919.

Dismissed the Service by Sentence of a G.C.M.

Haveland, Lieut. F., 8th Dec., 1920.

Deaths.

Copeland, Capt. R. R., D.S.O., M.C., killed in action, 24/25th July, 1920.
Dallas, Lieut. A. S., M.C., accidentally drowned, Secunderabad, 30th Jan., 1921.
Jennings, Brig.-Genl. H. A. K., C.I.E., (retired) at Delhi, 15th Jan., 1921.
Stammas, 2nd Lieut. T. L., (retired)

The following Casualties since 19th October, 1920, in Warrant Officers are published for information.

R.H. and R.F.A.

Discharged.

R.S.M.

1027926 Macalister, A. J., R.F.A., 3rd Nov., 1920.
1031262 Sugden, W., R.F.A., 15th Feb., 1921.
1021576 Batson, D. G., R.F.A., 18th Feb., 1921.

T.S.M.

1018923 Marshall, J. E. W., D.C.M., R.F.A., 10th Dec., 1920.
1020724 Aird, T., R.F.A., 27th Dec., 1920.
1020517 Dawson, E., R.F.A., 31st Dec., 1920.
1040226 Scott, G. T., R.F.A., 1st Jan., 1921.
1019292 Gattrell, A., R.F.A., 1st Jan., 1921.
1019432 Swain, J., D.C.M., R.F.A., 2nd Jan., 1921.
1027243 Gillard, W. H., D.C.M., R.F.A., 7th Jan., 1921.
1019558 Turrell, C., D.C.M., R.F.A., 23rd Jan., 1921.
1028926 Cockings, S., R.F.A., 18th Feb., 1921.

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Q.M.S. Instr. (Gym.)

1019090 Stevenson, A., R.F.A., 29th Jan., 1921.

B.S.M.

1023879 Hall, S. J., R.H.A., 13th Nov., 1920.
1018956 Warner, J., R.H.A., 2nd Jan., 1921.
1024007 Wingate, H. E., D.C.M., R.H.A., 14th Jan., 1921.
1022761 Sinnable, F., R.H.A., 22nd Jan., 1921.
497 Bird, R. P., R.F.A., 26th Aug., 1920.
1028618 Stewart, A., D.C.M., R.F.A., 30th Sept., 1920.
1019279 Hughes, T., R.F.A., 26th Oct., 1920.
1719 Louge, T., R.F.A., 29th Oct., 1920.
1019405 Wood, A., M.M., R.F.A., 6th Nov., 1920.
1036857 Dagg, W. G., D.C.M., R.F.A., 6th Nov., 1920.
1037054 Lowe, W., R.F.A., 9th Nov., 1920.
1018608 Marshall, E. G., R.F.A. 12th Nov., 1920.
1018966 Woolnough, E., R.F.A., 17th Nov., 1920.
1023678 Jacobs, W., R.F.A., 19th Nov., 1920.
1023483 Kean, H. E., M.M., R.F.A., 25th Nov., 1920.
1040233 Wood, W. H., R.F.A., 25th Nov., 1920.
1030954 Holmes, J. J., R.F.A., 26th Nov., 1920.
1028925 Bishop, G., R.F.A., 29th Nov., 1920.
1033106 Sage, A. W., R.F.A., 1st Dec., 1920.
1028719 Williams, C., R.F.A., 3rd Dec., 1920.
1024086 Malone, M. J., R.F.A., 6th Dec., 1920.
1018914 Wilford, F., D.C.M., R.F.A., 8th Dec., 1920.
1025816 Erskine, J. E., R.F.A., 8th Dec., 1920.
1023578 Beard, J. G., R.F.A., 9th Dec., 1920.
1040225 Taylor, A. A., M.M., R.F.A., 11th Dec., 1920.
1019415 McDonald, R., R.F.A., 12th Dec., 1920.
1019275 Collins, J., R.F.A., 12th Dec., 1920.
1020520 Eden, G., R.F.A., 14th Dec., 1920.
1042059 Mugford, F., R.F.A., 20th Dec., 1920.
1024239 Dow, J., R.F.A., 23rd Dec., 1920.
16586 Ridout, E. A., R.F.A., 3rd Jan., 1921.
1019325 Sayer, A. E. J., R.F.A., 5th Jan., 1921.
1019603 Gladwell, W., R.F.A., 7th Jan., 1921.
1032338 Walker, G. F. W., R.F.A., 9th Jan., 1921.
1019319 Walker, W. H., R.F.A., 10th Jan., 1921.
1019006 Dutton, C. W., D.C.M., R.F.A., 12th Jan., 1921.
1032340 Gray, A., R.F.A., 19th Jan., 1921.
1031584 Priestley, C. E., R.F.A., 22nd Jan., 1921.
1033604 Goodheart, F. W., D.C.M., R.F.A., 23rd Jan., 1921.
1018972 Butler, C. P., R.F.A., 23rd Jan., 1921.
1040246 Brown, W., R.F.A., 25th Jan., 1921.
1019471 Roast, T., R.F.A., 27th Jan., 1921.
1019310 McCartney, J., D.C.M., R.F.A., 28th Jan., 1921.
1021600 Drew, J., R.F.A., 28th Jan., 1921.
1042333 Rookwood, D. W., R.F.A., 30th Jan., 1921.
1018941 Marker, F., R.F.A., 4th Feb., 1921.
1018917 Cooper, G., R.F.A., 5th Feb., 1921.
1019440 White, F. J., R.F.A., 8th Feb., 1921.
1023381 Barr, G. E., R.F.A., 10th Feb., 1921.
1018925 Horsfield, A., M.C., R.F.A., 12th Feb., 1921.
1019663 Grumbridge, G., R.F.A., 13th Feb., 1921.
1018638 Cowley, A. J., D.C.M., R.F.A., 16th Feb., 1921.
1019481 Street, A. J., R.F.A., 20th Feb., 1921.
1019307 Spiceley, A. P., R.F.A., 21st Feb., 1921.
1024039 Newman, S. H., R.F.A., 22nd Feb., 1921.
1024361 Winterton, J., R.F.A., 25th Feb., 1921.
1024157 Hammerton, J., M.M., R.F.A., 25th Feb., 1921.
1019281 Whitehead, F., D.C.M., R.F.A., 27th Feb., 1921.
1045924 Dean, G. W., R.F.A., 27th Feb., 1921.
1019449 Little, W. H., M.M., R.F.A., 7th March, 1921.
1025460 Barnes, J., D.C.M., R.F.A., 9th March, 1921.
1033714 Houghton, W., R.F.A., 10th March, 1921.
1019442 Harris, J., R.F.A., 11th March, 1921.
1019650 Adams, G., R.F.A., 11th March, 1921.

Died.

B.S.M.

1040205 Beer, F., R.F.A., 23rd Jan., 1921.

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Transferred.

R.S.M.

1025799 Potter, W., M.C., R.F.A., Transferred to R.G.A. on appointment as Garrison Sergt.-Major, Woolwich, 17th Jan., 1921.

B.S.M.

1040215 Lovell, G. P., R.F.A., To Corps of Military Accountants, 13th Nov., 1920.

Reverted.

B.S.M.

1019467 Barry, T., R.F.A., To B.Q.M.S., at own request, 9th Oct., 1920.
1024526 McHarg, J. C., R.F.A., To Sergt., at own request, 6th Dec., 1920.

T/B.S.M.

41158 Warren, C. J., R.F.A., to Sergt., 30th April, 1920.*
52189 Sturgeon, L. A. V., R.F.A., to Sergt., 30th April, 1920.*

*Under A.C.I. 264 of 1920, which authorises reversion to their substantive ranks of men promoted to temporary rank under A.C.I's 386 and 561 of 1919.

Promotions.

B.Q.M.S. (T/S.M.)

1043191 Bishop, F., R.F.A., promoted Warrant Officer Class I. (R.S.M.), 19th Sept., 1920.

B.S.M. (T/S.M.)

1037329 Hale, G., R.F.A., promoted Warrant Officer Class I. (R.S.M.), 30th Sept., 1920.

B.Q.M.S. (T/S.M.)

1019301 McCormack, W. J., R.F.A., promoted Warrant Officer Class I. (R.S.M.), 4th Nov., 1920.

Commissioned.

R.S.M.

1029970 Stewart, W. F., R.F.A., Commissioned Lieut. (D.O.), 7th Dec., 1920.

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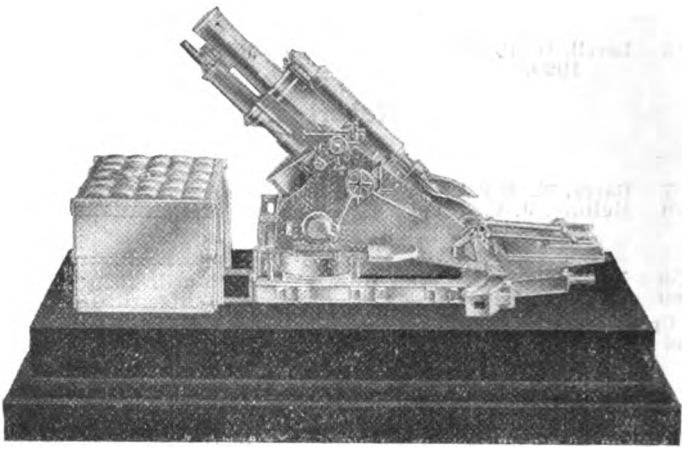

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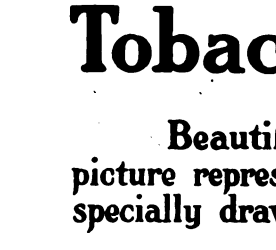

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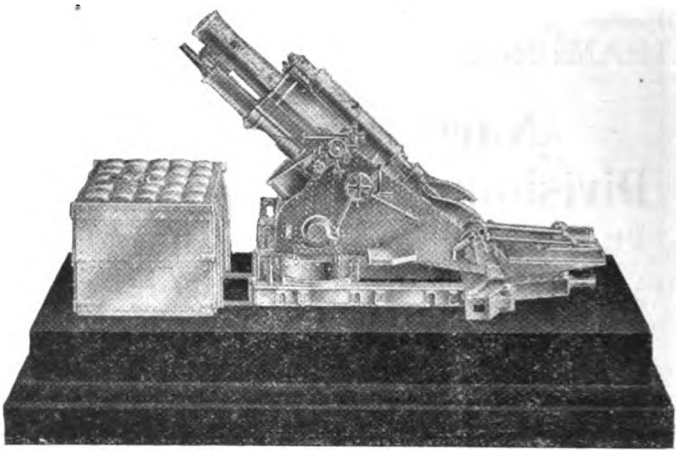

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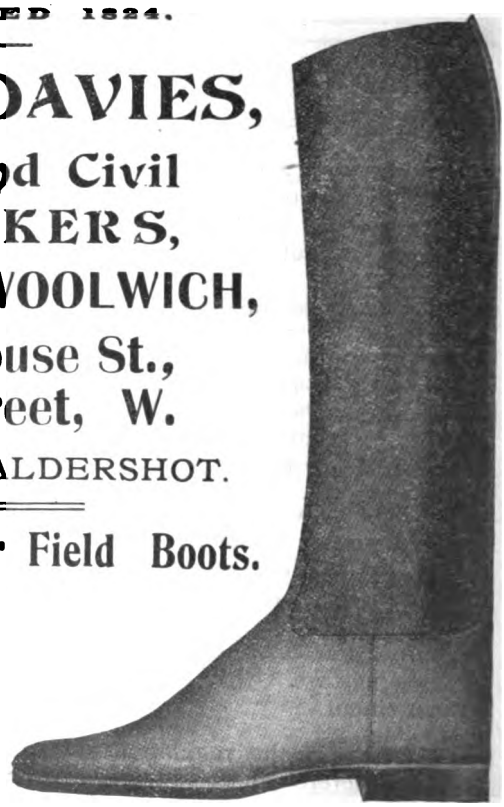

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